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Evaluating household expenditures and their relationship with house prices at the microeconomic level*

Mark Smith†

Abstract

Over much of the past 40 years, cycles of house price and consumption growth have been closely synchronised in New Zealand. Three main hypotheses for this co-movement have been proposed in the literature;

(i) An increase in house prices increase homeowners' wealth, which increases their desired level of expenditure;

(ii) Rising house prices facilitates additional consumption by reducing credit constraints to homeowners; and

(iii) House prices and consumption have been influenced by common factors, including expectations of future income growth.

This paper uses repeated cross sectional analysis of household level data over the 1984 to 2007 period to ascertain which of these hypotheses is more valid for the New Zealand case. A positive correlation between real house prices and real household expenditures is evident for most tenure and age groupings. However, research findings from this paper suggest that the house price and consumption relation is most likely to be due to wealth effects.

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* The views expressed in this paper are those of the author and do not necessarily reflect the views of the Reserve Bank of New Zealand or Statistics New Zealand. Special thanks to Rob Hamilton, Tim Hampton, Tim Ng, Richard Fabling, and Statistics New Zealand. All errors and omissions are my own. Access to the data used in this article was provided by Statistics New Zealand under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975.

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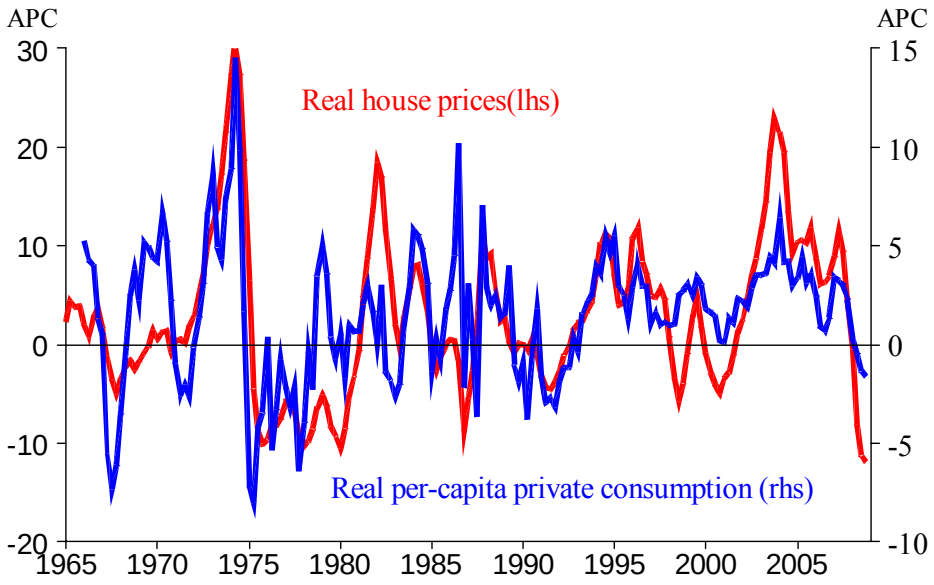
1 Introduction

Housing is the predominant component of wealth for the typical household in many countries. The household sector (residential investment and private consumption) accounts for approximately two-thirds of total economic activity. Hence developments in this sector are likely to have an important bearing for monetary policy via their impacts on activity and inflation. There are also financial stability implications to consider with house prices and household debt levels having risen strongly since the start of the decade.

The magnitude and volatility of housing wealth have led many to suggest that house price changes have significant effects on aggregate consumption. Indeed, a number of overseas studies have found a positive relationship between increases in aggregate housing wealth and consumption. Muellbauer and Murphy (1990), for example, argued that house price increases and financial liberalisation stimulated a consumption boom in the United Kingdom in the late 1980s. More recently Case, Quigley and Shiller (2003) find a strong correlation between aggregate house prices and aggregate consumption in a panel of developed countries from the late 1970s through the late 1990s.

In New Zealand, movements in house prices tend to coincide with fluctuations in consumer spending. Dunstan and De Veirman (2007) use a Vector Error-Correction Modelling (VECM) approach to examine the relationship between real house prices and real per-capita consumption from the March 1980 to December 2006 quarter. A permanent one-percent increase in real per-capita housing wealth is associated with a 0.19 percent increase in real per-capita consumption in the long run. This estimated long-run elasticity from housing wealth is much larger than the elasticity from net financial wealth. Hull (2003) finds that an increase in real house prices lifts consumption. Using annual data from the 1972 to 2000 period she finds that the long-run marginal propensity to consume from an increase in real housing wealth is between 6 and 7 percent.

Figure 1
Real per-capita consumption and real house prices



Source: PropertyIQ, Statistics New Zealand.

While past New Zealand studies confirm a positive relation between house prices and private consumption growth at the aggregate level, there has not been any research to ascertain this linkage at the household level. There are a number of competing explanations for the close correlation observed between house price movements and consumption growth. These include:

- Wealth effects

Rising house prices boosts the balance sheet positions of homeowners, which in turn leads to higher consumer spending, either via homeowners reducing precautionary saving or by accessing their greater housing wealth via withdrawing equity.[3] If this hypothesis is correct, we would expect to see a greater consumption response from house price movements for homeowners. It is also likely that consumption responses will be greater by older homeowners who have had longer time to build-up more housing equity, and are more likely to realise equity via trading down to less expensive houses.[4]

[3] See Case et al (2003).
[4] However, the UK experience suggests that trading down involves reducing debt as much as increasing consumption (see Benito and Power 2004).

- Easing of collateral constraints

Housing is an asset that can be used as collateral in a loan. An increase in house prices may lead to an increase in consumption not because of a wealth effect, but because it allows borrowing-constrained homeowners to smooth consumption over the life cycle.[5] If this is more valid, we would expect to see greater responsiveness of homeowners who may have been credit constrained. This would typically include first home buyers who have recently purchased their dwelling. Some older homeowners (who are more likely to be asset-rich but cash-poor) would also fall into this category.

- Common influences

House prices and consumer spending could both be driven by common influences. For example, house prices may respond to future income prospects, to which current consumption also responds provided that households are not credit constrained.[6] If this is more valid we would expect to see a greater increase in consumption (particularly since the reforms of the late 1980s/early 1990s) by younger household cohorts, as they increase consumption to a greater extent to account for their relatively higher increase (revisions) in lifetime perceived income.

The objective of this paper is to take a household-based perspective to examine the influences of New Zealand consumption growth over the 1984-2007 period. This would enable the relevance of these hypotheses to be assessed. This may shed some light on what is driving this relationship at the macroeconomic level, and will assist in projecting how consumption might respond as house prices decline.[7]

Section 2 outlines the methodology and data sources. Section 3 provides further detail on the repeated cross section analysis used in this study. Section 4 presents econometric results from a baseline model of household expenditures. Further analysis using a variety of other house price specifications are summarised in section 5. A summary of results and brief conclusion follow.

[5] See Ortalo-Magné and Rady (2006).

[6] See Attanasio et al (2005).

[7] Findings from United Kingdom studies differ on which of these hypotheses is the more valid. For example, Attansio et al (2005) find that common influences provide the most likely explanation for the correlation evident in UK data, whereas a study using the same dataset by Campbell & Coco (2007) put more weight on wealth effects.

2 Methodological approach and data used

Following an approach similar to that used in overseas studies this analysis is based around a life-cycle model of aggregate consumption.[8] Empirically, this involves looking at consumption time series for a number of household cross sections (cohorts of households identified by the date of birth of the household 'head' (defined as the principal owner or renter of the property).

2.1 Modelling approach

In this model consumption would depend upon age and lifetime wealth:

$$X^h_t = \kappa\,(age^h)\, W^h \exp(\varepsilon^h_t) \qquad (1)$$

Where:
X^h_t = consumption expenditure of household h at time t;
age^h = composition of household h;
W^h = lifetime wealth of household h; and
ε^h_t = residual term.

The function (age^h) captures several factors, including: the age composition of the household (and therefore the distance from the end of their lives), changes in household needs and other influences. We can capture some of these factors using observable variables (such as family size and composition), while we proxy others with a flexible function of age. Variation between different cohorts' non-housing lifetime wealth is captured by cohort dummies and, possibly, other variables that we discuss below.

By incorporating observable variables, such as family size and composition that capture some of the age and other effects on consumption, and using a polynomial in age (function *f*), this becomes:

$$\ln X^h_t = f\,(age^h) + \gamma' z^h_t + \ln W^h + \varepsilon^h_t \qquad (2)$$

Where:
z^h_t = observable variables, including family size and composition, that capture some of the other effects on consumption.

[8] See Ando and Modigliani (1963), Modigliani and Brumberg (1954).

Averaging over birth cohort, *c* gives:

$$\ln X^c_t = f(age^c) + \gamma' z^c_t + \acute{\alpha}^C + \varepsilon^c_t \quad (3)$$

Where:
$\ln X^c_t$ = average of $\ln X^h_t$ across all households belonging to birth cohort c; and
$\acute{\alpha}^C$ = average (log) lifetime wealth of households belonging to cohort c.

In the context of a dynamic analysis, based on average cohort techniques, there are additional reasons to control for observable variables, captured in vector *z*. Controlling for variables that are fixed over the life cycle in the group population but are not fixed in our sample (for example, due to sampling variation) and that are correlated with consumption, help improve the precision of equation estimates. Furthermore, if there is significant attrition from the group that is correlated with consumption, then equation estimates will be biased by sample selection unless suitable controls are imposed.

It is plausible that households of different size face different marginal utilities from the same level of expenditure, thus different lifetime profiles of household size over different cohorts would affect the age profile of the consumption level. Since the HES is a random sample of the New Zealand population using it to calculate the mean log consumption of each cohort over time should give us an unbiased estimate of the expected age profile for a member of a given cohort.

Averaging over birth cohort, *c* gives:

$$\ln X^{ch}_t = \acute{\alpha}^C + f(age^c) + \gamma' z^{ch}_t + \acute{\alpha}^C + \varepsilon^c_t + u^{ch}_t \quad (4)$$

The superscript ^{ch} denotes household *h* belonging to cohort *c*, and *ut* is the household's deviation from the cohort average.

We assume that the consumption innovations ε^c_t average out to zero over time in our regression. Notice that the flexible function of age and cohort dummies takes care of any deterministic trends in the data.

The use of household level data enables us to estimate the response of consumption to house prices, and control for changes in household income, the degree of household leverage, and household demographics. We can make use of the fact that households are heterogeneous along several dimensions, including age, homeownership status, to at least partially

distinguish between aggregate and household specific effects of house prices on household consumption.

2.2 The data

Household Economic Survey
The household economic survey (HES) was conducted annually from March 1974 to 1988 years and subsequently shifted to a triennial cycle, with surveys in the June 2001, 2004, and 2007 years. Electronic records are available since the 1984 survey, with 18 surveys over the 1984 to 2007 period.

The HES records expenditure and income data for all New Zealand resident households living in permanent dwellings. While the HES is a continuous survey of households, each household is interviewed only once. Each quarter there are about 750 households interviewed, equating to approximately 3,000 households per year.

During a two-week period the adult members of each household keep a diary of their consumption expenditures. The survey also contains a variety of other information, including the region where the household lives, income, period at which they have resided at their current address, demographics such as age and household composition, homeownership status, and mortgage information.

The HES does not include complete information on the value of assets held by households. For example, coverage of the total number (and value) of property holdings is incomplete. As such, it is not possible to use the HES data to ascertain the extent to which increases in balance sheet wealth have contributed to higher consumption by particular groups.

However, there is a question in the survey which asks respondents if they make payments on another property. Over the 1984 to 2007 HES, approximately 7 percent of households make payments on other properties. It seems likely that these other properties would include rental investment properties or holiday homes. The HES does not record the number or value of these other properties.

Following studies overseas I restrict the sample of households to where the main respondent from the survey is aged between 18 and 75. I also remove

some records where only partial information is included, or where the disposable income of the respondent household is negative.[9]

This provides around 50,000 household years to work with, over a 23 year period. This is less than comparable studies for the United Kingdom - Attanasio et al (2005) have roughly 150,000 person years over a 24 year period obtained from the Family expenditure survey (1978 to 2002), whereas Campbell and Coco (2007) have around 90,000 person years from the same survey over the 1988 to 2000 period.

I convert nominal variables to real values using the private consumption deflator. Appendix A provides a list of the data sources used in this study.

Other data

There are some gaps in the coverage of the HES. Data on house price values for owner occupiers prior is not available prior to 1992, and some post 1992 records are incomplete. While proxying these records with a national house price measure may broadly representative for the full HES sample, it would not be able to explain regional differences in expenditures that are related to different regional house price trends. Campbell and Coco (2007) show evidence of a positive effect of regional house prices on consumption in the UK, over and above that explained by national house prices.

As there has been considerable regional variation in house price movements between Auckland and the rest of the country I calculate regional indices for these two geographical areas using house price data provided by PropertyIQ.[10] I match house price data for the greater Auckland area (which includes North Shore, Auckland, Waitakere and Manukau cities) to households residing in these regions, and use the non-Auckland house price measure for other regional areas. Using regional house price indices allows an investigation of whether regional house prices explain regional expenditures, beyond national house prices.

[9] A later check of these changes shows they do not significantly affect the equation results.

[10] I use QV house price indexes for New Zealand and Auckland and use the HES population weights to derive a house price index for the rest of New Zealand. Analysis shows these imputed regional house price measures bear a strong positive correlation with property prices reported by homeowners in the HES sample over the 1992/2007 period.

The UK studies differ on the number of regions examined. For example Attanasio *et al* (2005) use 11 regions in the UK whereas Campbell and Coco (2007) use three.

To proxy the service costs of housing, data for dwelling rents are added to the dataset. I calculate regional dwelling rent measures for Auckland and the rest of New Zealand, using dwelling rental information provided by the Ministry of Housing. This data is available since 1993, with earlier estimates obtained from the dwelling rentals component of the CPI.

The HES includes electronic records of the interest rate charged on mortgage debt held by households with outstanding mortgages. However, records from the HES are incomplete so some adjustments are needed to produce updated estimates. I use Reserve Bank of New Zealand estimates of the average effective mortgage rate. These estimates are closely correlated with those records that were filled out by HES respondents.

2.3 Which measure of consumer spending?

One of the aims of this study is to ascertain the degree to which changes in household spending for different cohorts relate to household consumption, as measured in the System of National Accounts (SNA). Although household surveys provide an opportunity for examining trends in different household subgroups there are likely to be differences between grossed up measures of household expenditure from the HES to total consumption from the national accounts. These differences are likely to reflect different data sources and methodologies and suggest some caution in inferring results based on the HES. A paper by Statistics New Zealand finds that a grossed up measure of total expenditure from the HES is likely to considerably understate the expenditure of consumers.[11] However, as shown in figure 3, both display similar cycles in consumer spending.

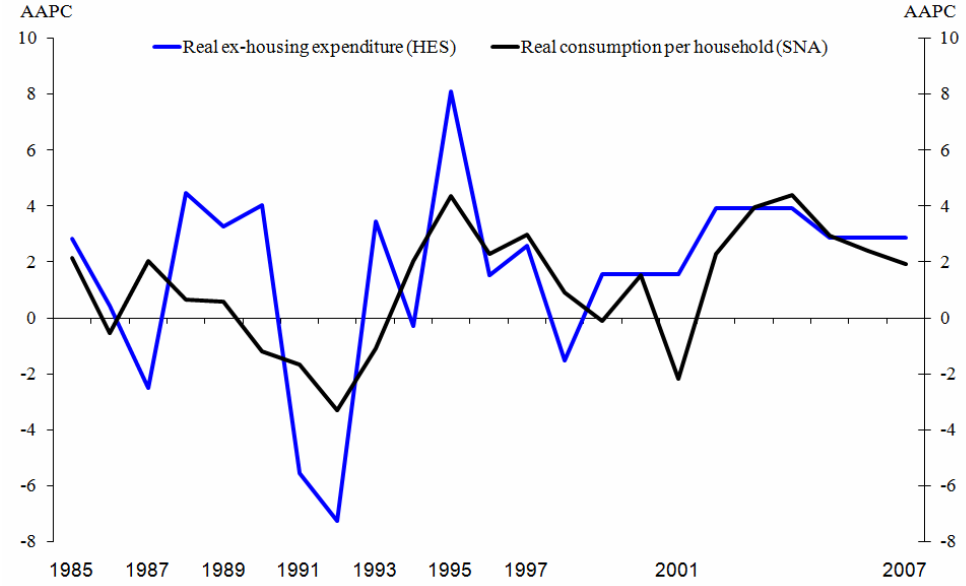
There may be grounds for looking at a smaller subset of expenditures from the HES. Overseas studies do not use total expenditures from household surveys but use subgroups of household expenditure. Campbell and Coco (2005) focus on non-durable expenditures from the United Kingdom Family

[11] See Bascand *et al* (2006). They find over the 1984 to 2004 period the HES captures between 80-84 percent of the equivalent outlays from SNA consumption.

Expenditure Survey (FES), whereas Attanasio *et al* (2005) use an ex-housing measure of real expenditure from the UK FES.

In the New Zealand case, some of the expenditures recorded in the HES do not relate to measured consumption from the national accounts. This is most evident for housing: expenditures incurred in the construction and purchase of new dwellings are recorded as housing expenditure in the HES but are typically categorised as dwelling investment in the national accounts.[12] Hence, there are grounds for adjusting the HES figures to make them more compatible with the consumption expenditures recorded in the national accounts. Further investigation shows that the level of ex housing expenditure from the HES produces a marginally tighter correlation with total SNA household consumption than just using total expenditure.

Figure 2
HES versus SNA measures of real consumption growth



Source: Statistics New Zealand, Author's calculations.

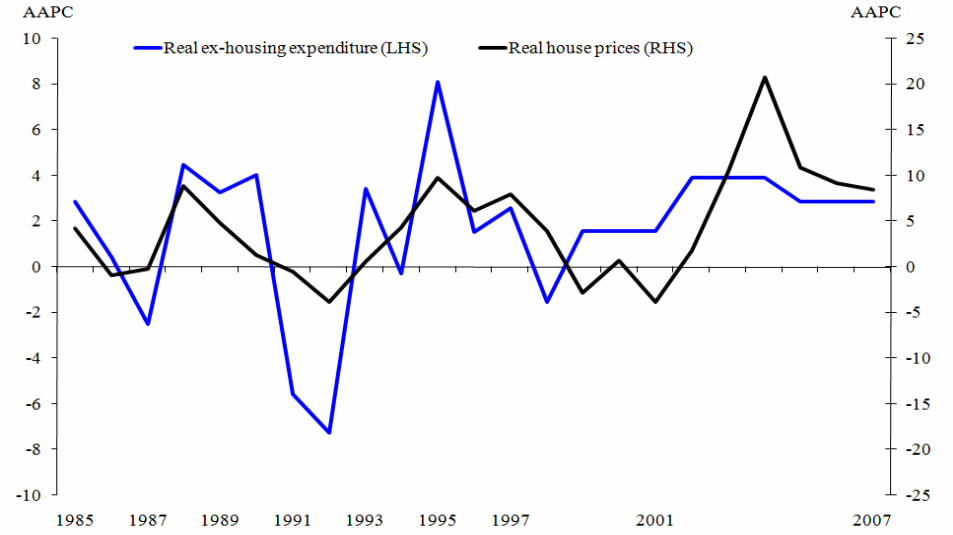
[12] Expenditure on housing has been trending up relative to other HES expenditures. In the June 2007 year housing expenditure accounted for approximately 25 percent of total (ex NCO) household expenditure, versus slightly less than 20 percent in the March 1984 year. Housing expenditure includes rental payments and mortgage principal repayments but does not include non-principal mortgage repayments.

Hence I elect to follow Attanasio et al (2005) and use ex-housing measure of household expenditure as the major dependent variable in the following analysis. I refer to this measure as core household expenditure. Figure 2 shows that movements in real core household expenditure from the HES tend to broadly track movements in real SNA consumption per household.

Figure 3 compares movements in real core household expenditures with changes in real house prices. In order to smooth out some of the annual fluctuations in spending growth I follow the approach used by Attanasio et al (2005) and average over periods corresponding to high or low consumption growth. High growth phases occur where real annual core household expenditures average above 1.5 percent (which broadly corresponds to the average annual increase in real core household expenditure over the HES sample period).[13] This shows that periods of higher growth in core household expenditures tend to be positively correlated with phases of high increases in house prices.

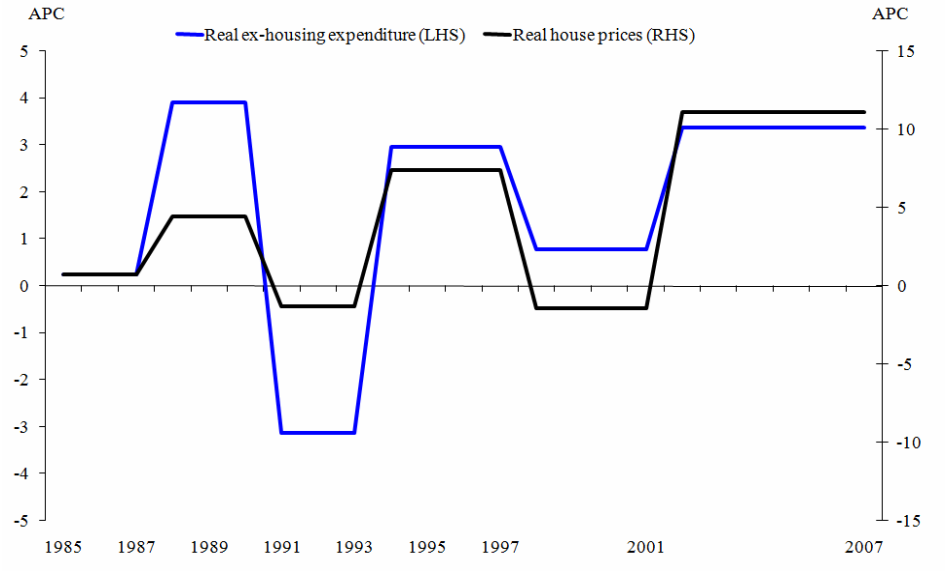
Figure 3
Average real core household expenditures and house prices

Annual changes



[13]Figures from the 1998 to 2001, 2001 to 2004, and 2004 to 2007 periods have been converted to an indicative annual percentage change via linear interpolation. Real house price growth over the HES sample averaged approximately 4 percent.

Period averages



Source: HES, PropertyIQ, Author's calculations.

The advantage of using a household level dataset is that it allows us to investigate the responses of different groups to see which groups are driving this correlation. This will help to shed light on whether the positive correlation between house prices and consumption is being driven by wealth effects, changes to credit constraints, income expectations, or a combination of influences. I categorise the HES records by different splits for the age of the main respondent and for housing tenure (see table 1).

Table 1
Age and tenure breakdowns

Age of main respondent	Dwelling tenure
18 to 34	Own with mortgage
35 to 55	Own without mortgage
56 to 75	Live in paid rental accommodation

Table 2 summarises the portion of households from the 1984 to 2007 HES by age of main respondent and tenure. It shows that households living in paid rental accommodation make up about one-quarter of the sample, but this portion increased to around one-third in the 2006/07 HES. A greater portion of renter households tend to be in the under 35 age group relative to their total share of the sample. Similarly, about three quarters of older household (56-75 age bracket) tend to own their own home mortgage-free.

Table 2
Portion of households by age of main respondent and tenure
(2006/07 survey figures in brackets)

	Living in paid rental accommodation	Homeowner with		Total
Age		Mortgage	No mortgage	
18-34	14 (14)	12 (8)	4 (1)	30 (23)
35-55	8 (13)	20 (26)	15 (10)	44 (49)
56-75	3 (4)	3 (6)	20 (18)	26 (28)
Total	26 (32)	36 (39)	39 (29)	100 (100)
Observations				49,814 (2,267)

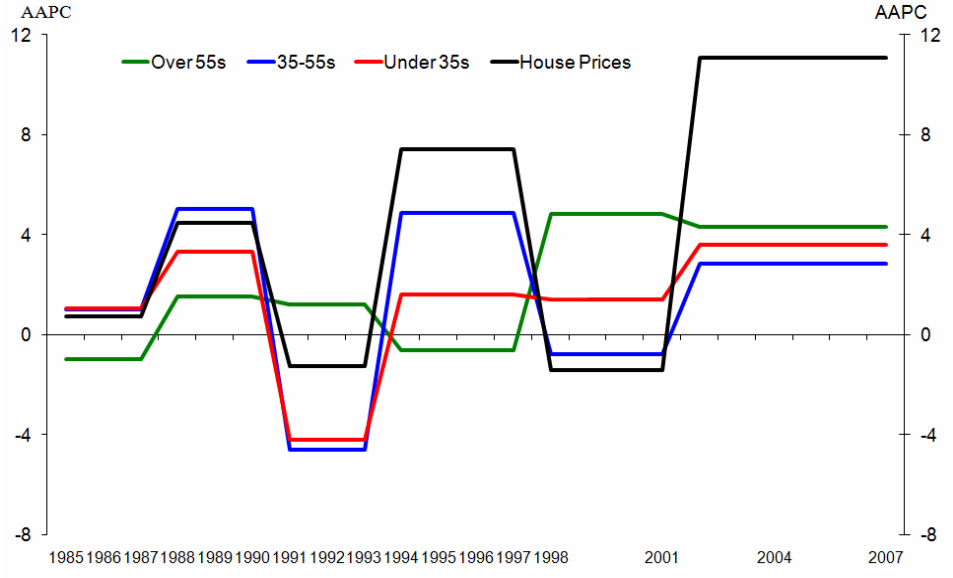
Source: HES, Author's calculations.

Comparing these proportions with those from the 2006/07 HES show a much lower proportion of homes are now owned without a mortgage. Changes in homeownership patterns have been particularly noticeable for main respondent households aged between 35 and 55.

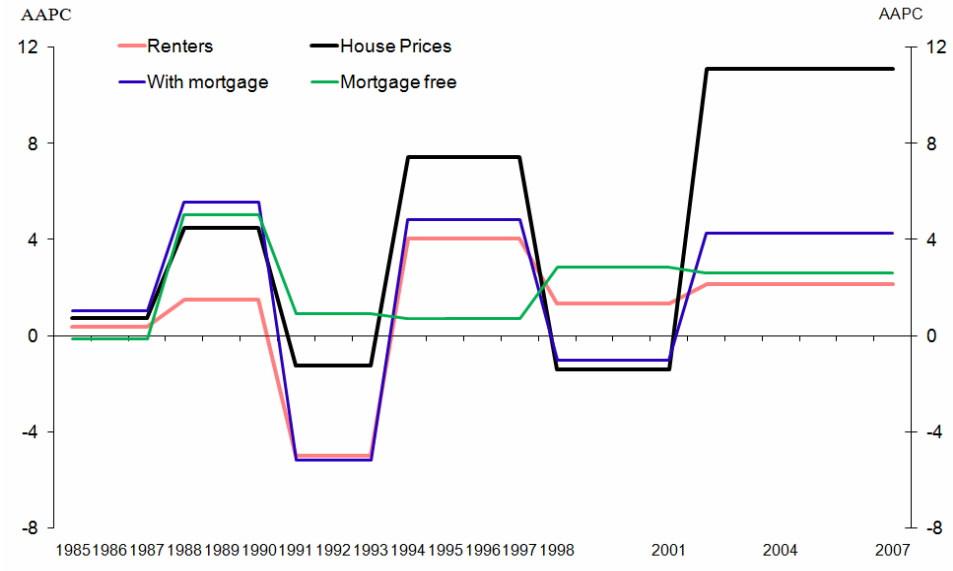
Figure 4 plots respective average growth rates of real house prices and real core household expenditures for these age and tenure groupings.

Figure 4
Real house prices and real core household expenditures

By age of main household respondent



By tenure



Source: HES, PropertyIQ, Author's calculations.

These charts suggest that the positive correlation between house prices and expenditure growth is fairly widespread across most age group and tenure categories.

Of the age groups, real non-housing expenditure growth for mid-age households (the 35s to 55s) appear to be the most correlated with average changes in real house prices (see also table 3). Expenditure growth for older households appears less correlated with house price movements than for other age groups. However, the rise in core expenditures of older households since the late 1990s is particularly noticeable.

Looking at housing tenure, it is apparent that movements in real core expenditures of households who own their own home with an outstanding mortgage appear more closely correlated with house price movements than expenditures of those living in rented accommodation. This suggests higher house prices may have facilitated higher spending by this group, via the relaxation of credit constraints. However, this may reflect higher mortgage interest payments for this group. The positive correlation for renters may reflect income expectations, a discouraged homebuyer effect, or could capture greater the availability of consumer credit during periods of house price strength (irrespective of tenure).

Table 3
Expenditure growth and correlation with real house prices

	Real ex-housing expenditures	
Household age	1984-2007 HES	
	Growth rate	Correlation*
18-34	1.4	0.68
35-55	1.5	0.67
56-75	2.0	0.21
Total	1.6	0.92
Real house price growth	3.9	

Source: HES, PropertyIQ, Statistics New Zealand, Author's calculations.
*Based on period average growth rates. Correlation coefficients calculated from group aggregates rather than individual observations.

On the basis of this evidence, however, it is difficult to ascribe to any one hypothesis. It suggests that the positive correlation in the macro data may not be attributable to any single hypothesis, but a combination of factors.

3 Repeated cross section analysis

The HES is not a longitudinal panel but a survey of households, in which each household is interviewed only once. As such, we cannot follow individual households over time and employ panel type estimation techniques. However, we can exploit the repeated cross-section nature of the survey. I employ the methodology introduced in Browning et al (1985) and Deaton (1985) and use repeated cross section analysis. By doing so this enables the relationship between house prices and consumption to be investigated across households and over the HES sample period. As the dataset is a repeated cross sectional sample I do not use panel estimation techniques (such as fixed effects estimation) but instead use robust OLS estimates, such as the White correction for heteroschedasticity.[14]

[14] This is a form of weighted least squares that downweights outliers that may be the result of survey errors. It is a compromise between deleting these points, and allowing them to violate the assumptions of OLS regression (see Wooldridge 2001 for further information). Given the large number of observations used in the regressions in this paper, the standard errors of the WLS estimates are only slightly larger than for OLS estimates.

The relationship between house prices and household expenditure is likely to depend on income and different household characteristics. To allow for these differences I impose a number of controls in the regression, including real household disposable income, the number of adults and children in the household, tenure status of the household, and the labour force status and educational qualifications of the main respondent. Demographics are controlled for by including polynominals of age. The main specification also uses and economy-wide estimates of real effective mortgage interest rates. Cohort dummies are also included in the regression analysis.

Controlling for variables fixed over the life cycle of the group population but not fixed in the HES sample (e.g. due to sampling variation) but are correlated with consumption also helps improve precision of estimates. However, as there are gaps in the HES survey years at the end of the 1984 to 2007 sample, the quality of statistical inherence will need to be closely examined.

One of the consequences of using a number of control variables in the regression is that these explanatory variables could be highly correlated with each other. If multicolinearity is present, this is likely to affect coefficient estimates, which are likely to be biased downwards if the explanatory variables are positively correlated.

While effort has been made to control for variation attributable to compositional changes within the HES dataset, there are some other potential limitations with this approach:

- Dividing the sample between homeowners and renters and treating homeownership status as an exogenous variable can introduce a sample selection problem as the decision to become a homeowner is endogenous, and correlated with individual characteristics such as income and consumption.[15]
- As the survey years are not continuous this limits the analysis. Like Attanasio et al (2005) the equation will only be estimated using a levels specification and not in first differences as in other studies.

[15] More problematic is that if there is also an effect on estimated covariances and regression coefficients. Even though in the regressions we are controlling for the income of the same individuals, there may be some correlation between changes in house prices and consumption that is simply due to renters becoming homeowners. This may bias our estimation results.

Robust OLS estimation has been used, as it was not possible to use GLS to control for the hetereogeneity of the estimation.

- The HES survey data, on which this analysis is based, can include substantial measurement error.
- It is not able to precisely identify households for whom the wealth effects of rising house price changes is largest, or for whom credit constraints are relaxed when house prices increase. It can only uncover how likely a person in a given cohort is to experience a wealth effect due to house price changes, or how likely is it that a person in a given cohort is borrowing constrained.

These considerations point to some caution in interpreting these results.

3.1 Deriving age group cohorts

I closely follow the approach taken by Attanasio and Webber (1995) and Campbell and Coco (2007) by looking at cohorts of households where the main respondent from the HES questionnaire was born in a particular year. I assume cohorts over the cross section are identical using the date of birth of the household head and housing tenure as the major decision variables.

From the 1984 to 2007 period I derive five cohorts based on the year of birth of the main respondent (see table 4).

Table 4
Household cohorts used in this analysis

Cohort number	DOB	Min age	Max age	Observations
1	Before 1936	48	75	8,340
2	1936-45	38	71	11,944
3	1946-55	28	61	11,390
4	1956-65	18	51	10,890
5	1966-	18	41	7,250
Total		18	75	49,814

Source: HES, Author's calculations.

The oldest cohort is for individuals born prior to 1935, and the youngest for individuals born after 1966. These particular cohorts were chosen to allow for changes in spending patterns across the different age groups. Hence the decision to analyse the expenditures of household cohorts with the main respondent groups born before or during world war two (cohorts one and

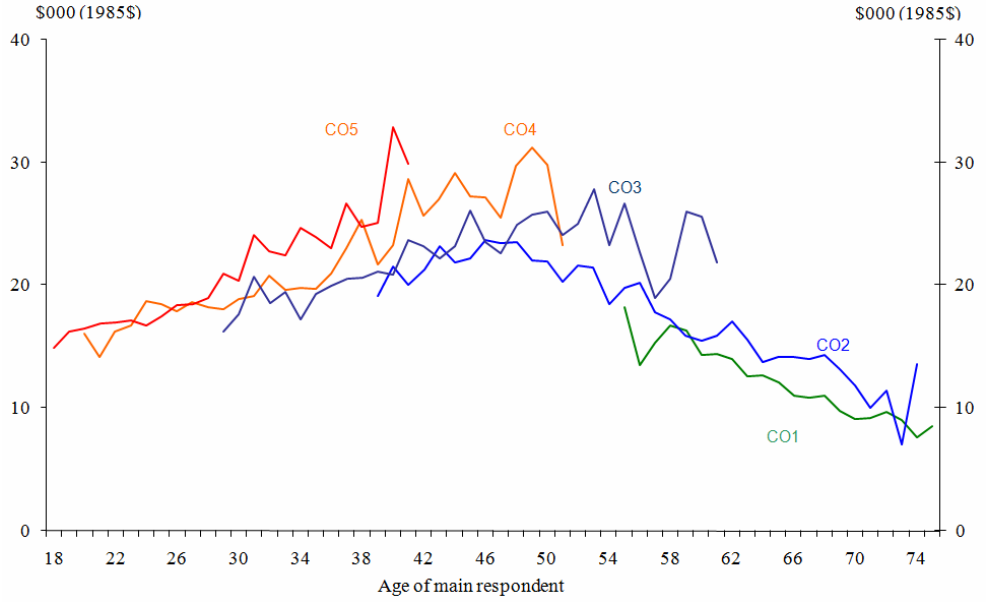
two), with baby boomers (cohorts three and four) and those born in more recent times (cohort five).

Figure 5 shows the hump shaped pattern of real core household expenditures and real household disposable incomes over the lifecycle broken down for the cohorts outlined in table 4.[16] It shows that for certain age of the main respondent, real non-housing expenditure and real disposable incomes are typically higher for the younger cohorts. This is partly attributable to higher real household disposable incomes for younger cohorts by a certain age.

The number of cohorts imposed (five), is less than the seven cohorts used by Campbell and Coco (2007) or the 15 by Attanasio et al (2005), partly reflecting the lower number of observations available.

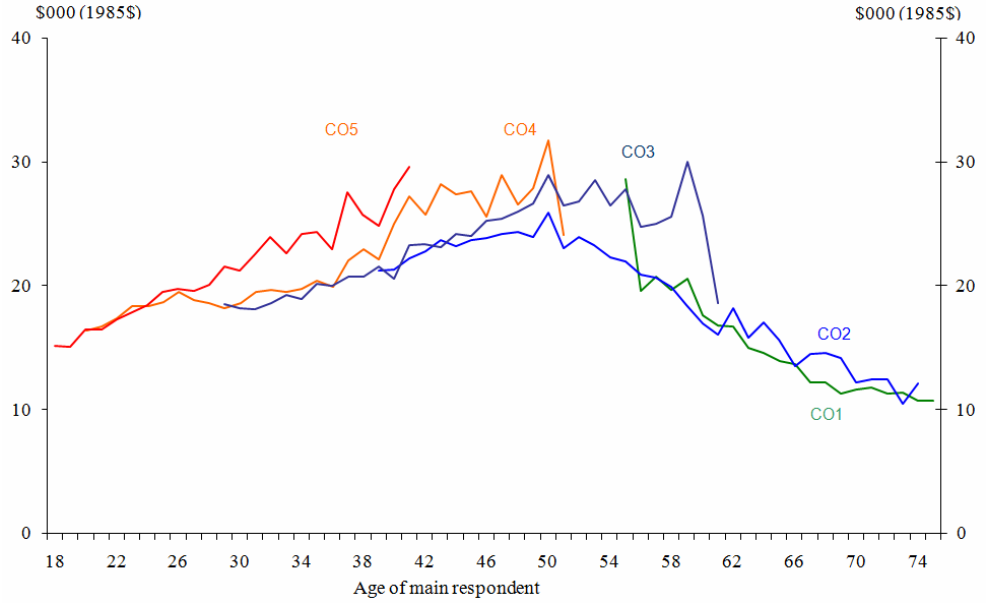
Figure 5
Real household expenditures and disposable incomes by age

Real ex-housing expenditure



[16] This is similar to findings obtained overseas (see for example, Campbell and Coco 2007, Attanasio and Browning 1995 and Carroll 1997).

Real household disposable income



Source: HES, Author's calculations.

4 The baseline regression

To quantify the link between house prices and expenditures I follow a similar approach to Campbell and Coco (2007) and Attanasio et al (2005).

In addition to regressing the level of real house prices to the level of real core expenditure, the regression controls for household disposable income, education, dwelling tenure, age of main respondent, household composition and other demographic factors.

The baseline specification is as follows:

$$\ln(Cxh_{i,t})=\beta_0+ \beta_1\ln(P_{i,t}) + \beta_2 EMR_t+ \beta_3\ln(Y_{i,t})+ \beta_4 Z_{i,t}+\varepsilon_{i,t} \qquad (5)$$

Where:
ln(Cxhi,t) is real non-housing expenditure for each household;
$\ln(P_{i,t})$ is the log of real house prices in the region;
EMR_t is the real effective mortgage interest rate at period t;
$\ln(Y_{i,t})$ is the log of real disposable household income; and
$Z_{i,t}$ vector of cohort characteristics, demographics, tenure, seasonal dummies.

Table 5 summarises the coefficient estimates for explanatory terms in the baseline regression of real core household expenditure (5), for several different specifications. The main baseline specification is equation (i), with the other equations used mostly to investigate the stability of the baseline coefficients. Specification (v) includes an alternative house price definition, used by Campbell and Coco (2007) to ascertain whether differences in regional house prices affect spending, over and above that affected by national house prices. Appendix B summarises the full equation results of these equation specifications.

Equation (i) includes real household disposable income (Y_t) real effective mortgage interest rates (EMR_t), and real regional houses prices as explanatory variables (P_t). It controls for demographics by including polynomials of respondent age (Age to Age4) and the number of adults (Numads) and children (Child) in the household. Also included are dummies for labour force attachment (Dnlf) and educational qualifications for the main household respondent (Dsec and Dpost). Tenure dummies to control for households living in rented accommodation (Drent) and for household living in their own home with an outstanding mortgage (Dmort) are included. The equation also includes a dummy to capture whether regional expenditures in the Auckland region are different from other regions (Dauck). To account for differing expenditures due to multi-dwelling ownership by some households, a dummy variable for these households is included (Dothp). Seasonal and cohort dummies are also included in the regression, but are not shown in table 5.

Equation estimates for the main equation specification shows that real core expenditures are positively related to real household disposable incomes and real house price levels, but are negatively related to real effective mortgage interest rates. Core expenditures are a positive function of the number of adults in the household, and the level of educational qualifications obtained by the main respondent. Expenditures are lower if the household includes adults not currently in the labour force (consistent with disposable incomes of these groups being lower).

Tenure dummies suggest that after controlling for income and demographic factors, real core household expenditures for homeowners with mortgages are considerably higher than other households. This may capture the impact of the credit channel in boosting consumer spending of credit constrained

homeowners, but may also reflect that non-principal mortgage repayments are included in core expenditures. If house price movements and interest rates are positively correlated

Table 5
Baseline regression results
Dependent variable: $\ln(Cxh_t)$

	Baseline Equation	Other specifications			
	(i)	(ii)	(iii)	(iv)	(v)
Constant	3.52*	2.40*	2.31*	2.38*	3.50*
$\ln(Y_t)$	0.49*	0.70*	0.52*	0.49*	0.49*
$\ln(Pr_t)$	0.34*	0.30*	0.31*	0.33*	
$\ln(Pnz_t)$					0.33*
$\ln(Pd_t)$					0.41*
EMR_t	-0.38*	-0.26*	-0.29*	-0.39*	-0.39*
Age	-0.06*	-0.11*	0.01	-0.07*	-0.07*
Age2	0.00*	0.00*	0.00	0.00*	0.00*
Age3	0.00*	0.00*	0.00	0.00*	0.00*
Age4	0.00*	0.00*	0.00	0.00*	0.00*
Numads	0.22*		0.23*	0.22*	0.22*
Child	0.01*		0.02*	0.01*	0.01*
Dnlf	-0.13*		-0.15*	-0.13*	-0.13*
Dsec	0.14*		0.17*	0.15*	0.15*
Dpost	0.20*		0.23*	0.21*	0.21*
Dmort	0.14*			0.13*	0.13*
Drent	-0.14*			-0.15*	-0.15*
Dauck	0.10*			0.10*	0.10*
Dothp	0.22*				
R^2	0.408	0.355	0.391	0.404*	0.404
Obs	49,814	49,814	49,814	49,814	49,814

Note. Pr_t denotes the index for regional house prices at time t, Pnz_t denotes the New Zealand index value, with $\ln(Pd_t)$ the difference between the log of regional and national indexes at time t. Seasonal and cohort dummies are reported in Appendix B.
*Significant at the 5 percent level.

It is also noticeable that core expenditures for households living in paid rented accommodation are considerably lower than for the sample average. The interpretation of these results is complicated by potential selection bias issues – over time the better off renters are likely to move into home

ownership, implying coefficients are likely to be overstated on homeowners. Real core expenditures of households living in the Auckland region are roughly 10 percent higher. Real core expenditures for households that make payments on another property are more than 20 percent higher than for other households.

Table 5 also includes some alternative baseline specifications. These are intended to show the extent to which the house price, household income and interest rate terms are affected by changing the explanatory variables within the equation. These show similar coefficients on the real regional house price term (0.3), irrespective of the specification used. However, it is noticeable that the coefficient on the real household disposable income coefficient is considerably larger in specification (ii). This is likely to reflect multicolinearity between household disposable incomes and terms capturing household composition, labour force status and education.

In specification (v) I switch from regional to national house prices, and add both national house prices and the difference between regional and national house prices. House price coefficients in this specification show that the difference between regional and national house prices is positive and statistically significant. National house prices are also positively signed and statistically significant. This confirms the existence of a regional link between house prices and consumption, irrespective of what happens at the national level. These results hold irrespective of whether the regional dummy is included in the specification.

Regional rents are not included in the baseline specification. Intuitively we would expect that higher rents would be negatively related to core household expenditures, via lowering the funding available for other spending. However, equation coefficients on the rent terms in the equation were positive, irrespective of dwelling tenure and the age group of household. The rent terms are strongly positively correlated with the house price terms in the equation (correlation coefficient of 0.8). To allay concerns over multicolinearity the rent variables are removed from the regression.

Despite the large number of explanatory variables used, the fit of the model is modest, with only about 40 percent of the level of real non-housing expenditures explained by the RHS variables. This is lower than similar studies overseas and might possibly reflect higher sampling error as the New Zealand HES sample is smaller.

Results for age groups and housing tenure

To check whether the equation results for these specifications were robust, I estimated the equations for individual age and tenure breakdowns as well as for the full HES sample. I also trialled removing the household disposable income terms from the regressions to investigate whether they affected the house price coefficients or their statistical significance. These changes had little impact on the house price coefficients, so they are not reported here.

Table 6 summarises the coefficient estimates on the house price terms from specification (i) of the baseline equation. Reported coefficients for the full age and tenure specifications are summarised in Appendix C.

Table 6
Real house price levels coefficients in baseline equation

	House price levels term $\beta_1 \ln(P_{i,t})$				Other property dummy
Age	Own with mortgage	Mortgage free	Renters	Total	
18-34**	0.21* (0.05)	0.23 (0.19)	0.16* (0.04)	0.19* (0.03)	0.26* (0.03)
35-55**	0.39* (0.04)	0.25* (0.06)	0.23* (0.07)	0.32* (0.03)	0.20* (0.02)
56-75**	0.18 (0.10)	0.56* (0.04)	0.29* (0.10)	0.49* (0.04)	0.24* (0.03)
All households	0.33* (0.03)	0.44* (0.04)	0.19* (0.03)	0.34* (0.02)	0.22* (0.01)

* Significant at the 5 percent level.
** Coefficients obtained from subgroup regressions.
Source: HES, PropertyIQ, Author's calculations.

The sensitivity of expenditures to house prices also varies by age of respondent and status of dwelling tenure. A 1 percent rise in real house prices coincides with a 0.3 percent increase in real core household expenditures. The house price coefficient tends to rise with age group of the household in the age group equations. The results generally show that changes in real house prices have a greater impact on the core expenditures of mortgage-free homeowners. However, responsiveness is greater for midage households with mortgages, indicating that mortgage finance may be a method of facilitating additional consumption for this group.

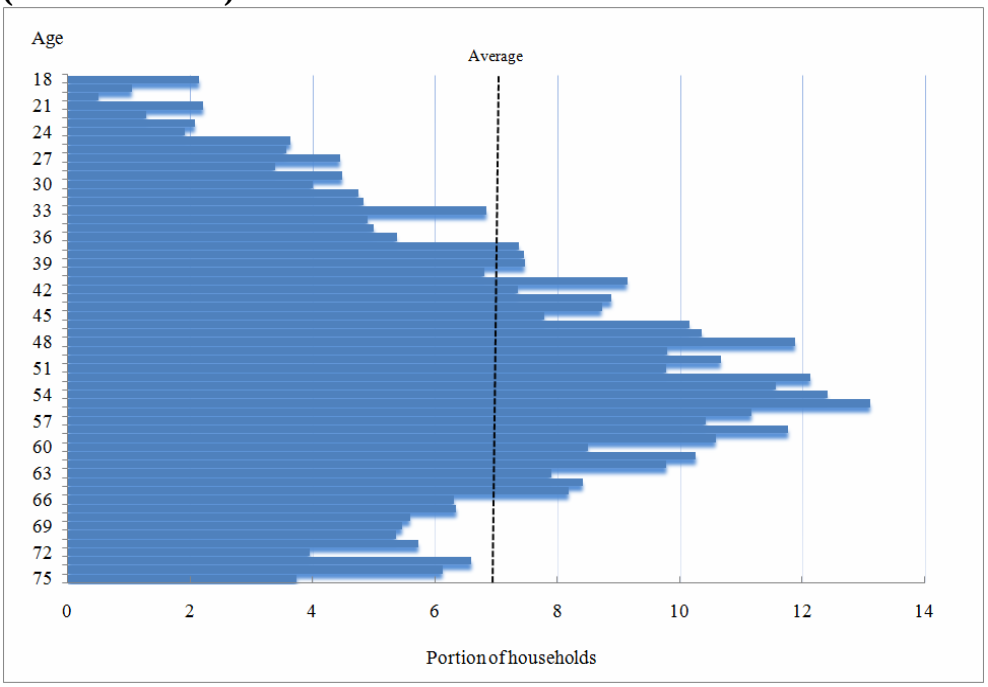
Tenure was an influential determinant of the expenditure responses on the midage and older household groups: for these groups, increasing house prices had a much stronger positive impact on the expenditures of homeowners, with the size of the coefficients highest for the older-age group. However, for younger households, a similar consumption response was evident irrespective of tenure.

The positive coefficient for households living in paid rented accommodation does not immediately lend support to the presence of a wealth effect, as we would expect to see a negative coefficient on the house price term for this group. The coefficients on the house price term rise by age, which suggests the positive correlation is not being driven by income expectations. It is possible the positive correlation is capturing a discouraged homebuyer effect or that the positive correlation may be affected by these renter households also experiencing a wealth effect, via owning other properties.[17]

Age subgroup equations show similar coefficients for households making payments on other properties. Real core expenditures for these households are approximately 20 percent higher than for other households. While the dummy coefficients are similar for the different age group equations, the portion of households making payments on other properties differs by age. Viewing the portion of households making payments on another property by age of the main respondent (figure 6) shows a hump shaped distribution, with higher proportions for main respondents aged in their 40s, 50s, and 60s.

[17]However, dividing the renter sample by whether they make payments on other properties (4 percent of all renters) yields positive house price coefficients for both subgroups (0.41 for those making payments on other properties, 0.18 for other renter households).

Figure 6
Portion of households making payments on another property (1984-2007 HES)



Source: HES, Author's calculations.

Sensitivity of core expenditures to mortgage interest rates

Coefficients on the real mortgage interest rate term are negatively related to real non-housing household expenditures (see table 7). A 1 percent rise in the real effective mortgage interest rate is associated with a 0.4 percent fall in real core household expenditures, other things being equal. The negative sign on the real mortgage interest rate coefficient is consistent with theoretical priors but differs from findings from Campbell and Coco (2007), who reported a positive real interest rate coefficient.[18]

[18] The negative coefficient in the New Zealand case is likely to reflect the negative contemporaneous correlation evident between real interest rates and household consumption/house price inflation. Bivariate correlation analysis over the 1983 to 2007 period reports a -0.07 coefficient between the level of real real house prices and the level of real effective mortgage rates (this correlation increases to -0.60 if the sample starts in 1990). Adding the real effective mortgage interest rate term does not substantively affect the house price coefficients in the baseline regression.

The age breakdowns show a varying degree of interest rate sensitivity. All else equal, core expenditures of young and mid-age households are negatively related to the level of real interest rates, whereas core expenditures of older households are positively related. For the latter group, this is likely to reflect their lower levels of debt relative to financial assets.

The real mortgage interest rate term varies by household tenure. Coefficients for households living in paid rented accommodation (-0.49) and households with outstanding mortgages (-0.52) are negative and statistically significant. For homeowners with outstanding mortgages the negative coefficient suggests that the positive effect on mortgage interest payments (which are included in core expenditure) is offset by lower expenditures in other areas. For households living in paid rental accommodation, the negative sign could reflect holdings of consumer debt.

Table 7
Real effective mortgage interest rate coefficients in baseline equation

	House price levels term $\beta_{2(}(EMR_t)$			
Age	Own with mortgage	Mortgage free	Renters	Total
18-34**	-0.59* (0.19)	-0.23 (0.51)	-0.47* (0.20)	-0.51* (0.13)
35-55**	-0.45* (0.15)	-0.98* (0.26)	-0.89* (0.33)	-0.70* (0.12)
56-75**	-0.72 (0.38)	0.43* (0.21)	0.00 (0.51)	0.22 (0.18)
All households	-0.52* (0.11)	-0.14 (0.16)	-0.49* (0.16)	-0.38* (0.08)

* Significant at the 5 percent level.
** Coefficients obtained from subgroup regressions.

Coefficients for homeowners without an outstanding mortgage are considerably smaller (-0.14 for all households in this group) and not statistically significant. However, the coefficient estimates for midage households (-0.98) are not what we would expect to find. It is possible that real mortgage interest rates are negatively correlated with factors influencing expenditures in this group that are not accounted for in the baseline equation. This is likely to include other forms of household wealth, including other property holdings, bonds or equities.

5 Other house price specifications

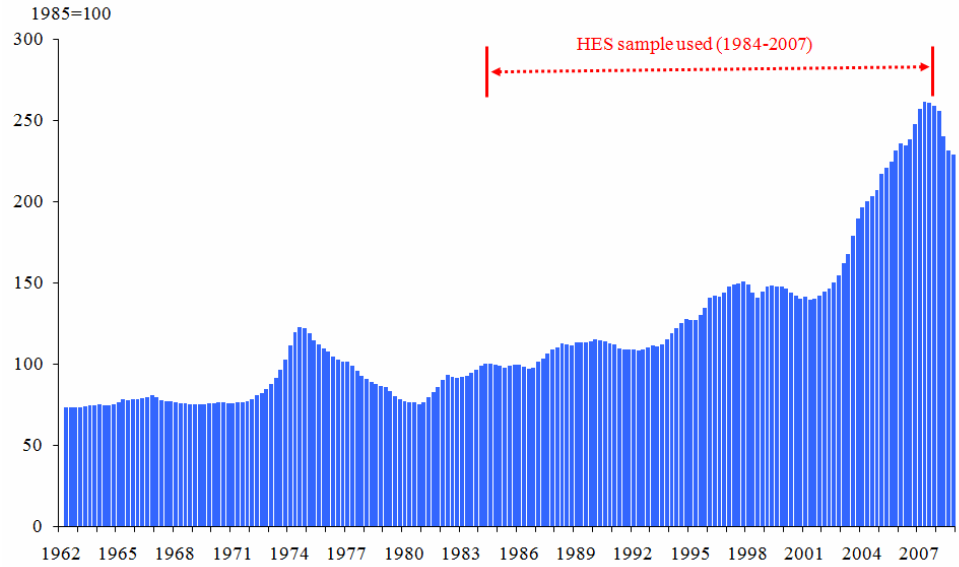
A number of alternative regressions were trialled in addition to the baseline model outlined in the previous section. These use different house price specifications and are used to draw out some insights on the findings suggested by the baseline equation.

Equation results for the full sample estimates are summarised in Appendix D.

5.1 Change in value since purchase

If collateral and wealth effects were important we would expect that changes in the value of a property since purchase would have an influential impact on the consumption decisions of households. As figure 7 shows there have been periods where house prices have plateaued or even declined in inflation adjusted terms.

Figure 7
Real house prices in New Zealand



Source: HES, PropertyIQ, Author's calculations.

Households who purchased houses in the mid-1970s (when prices were at a local peak) are likely to have seen their property values failing to keep up

with inflation until at least the late 1980s. Generally, however, the trend has been upward so people who have owned property for a long period of time have generally experienced capital gain in real terms.

The HES does not have a question in which respondent homeowners are asked the length of time they have owned their residential property. There is, however, a question in which respondents are asked how long they have lived at their current address for. For homeowners I assume this is an adequate proxy for the purchase date.[19]

Table 8 summarises the average period of tenure for homeowners as categorised by the age of main household respondent. These are generally quite stable over the HES sample period. Average period of tenure tends to increase with age. Periods of tenure tend to be higher for home owners as opposed to households living in rented accommodation.

Table 8
Average period of tenure (years)
(2006/07 survey in parenthesis)

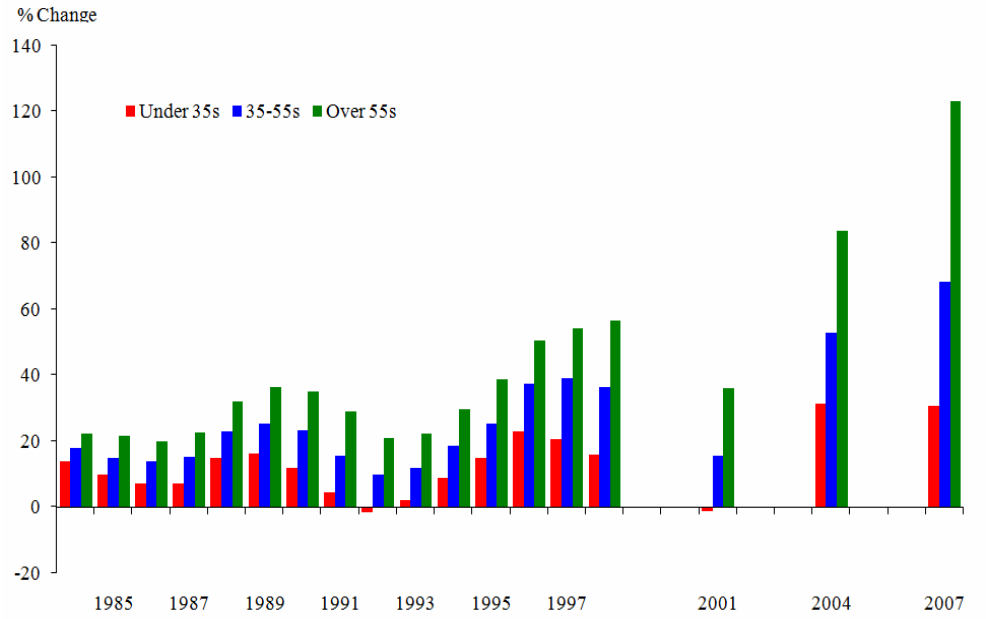
Age	Homeowners	Renters	Total
18-34	5 (4)	2 (2)	4 (3)
35-55	10 (8)	5 (3)	9 (7)
56-75	16 (18)	9 (6)	15 (16)
Total	11 (11)	4 (3)	9 (9)

Source: HES, Author's calculations.

Figure 8 shows the implied percentage gain in real house price since purchase by age group of homeowner. Older homeowners have been the major beneficiaries of the recent house price boom. As younger households have generally owned their properties for a shorter period of time, they are likely to have experienced smaller gains on average.

[19] These estimates may be biased if the household has been on the property ladder for longer than their current tenure – this is likely to be more of an issue for older households who are likely to have owned other homes before their current one.

Figure 8
Percentage change in real house prices since purchase by age



Source: HES, PropertyIQ, Author's calculations.

To assess whether gains in property values have a statistically significant impact on consumer spending, the following equation is estimated:

$$\ln(Cxh_{i,t})=\beta_0+\beta_1 EMR_t+\ln(\beta_2 Y_{i,t})+\ln(\beta_3 HPb_{i,t-p})+\beta_4 HPg_{i,t}+\ln(\beta_5 Yr_{i,t}) + \beta_6 Z_{i,t}+\varepsilon_{i,t} \quad (6)$$

Where:
$\ln(Cxh_{i,t})$ is the log of real non-housing expenditure for each household;
EMR_t is the real effective mortgage interest rate at period t ;
$\ln(Y_{i,t})$ is the log of real disposable household income;
$\ln(HPb_{t-p})$ is the log of the real house price at the date of purchase;
$HPv_{i,t}$ = value of house at date of survey;
$HPg_{i,t}$ = percentage increase in the real house price since purchase
(= $(HP_v/HP_b-1)*100$); and
$\ln(Yr_{i,t})$ is the log of the number of years living in current address; and
$Z_{i,t}$ vector of cohort characteristics, demographics, tenure, seasonal dummies.

Table 9 summarises the equation results. Coefficients on the real purchase price of the house (LRHPbuy) are positive and significant. They are also fairly uniform across other age groups, indicating that homeownership is a

positive determinant of core household expenditures. As such, coefficients for homeowners are larger than for all households.

Table 9
Change in house price since purchase - all households and homeowners

	Households		Homeowners	
Age	LRHPbuy	RHPgainpct	LRHPbuy	RHPgainpct
18-34	0.41*	-0.11*	0.55*	-0.02
	(0.03)	(0.05)	(0.03)	(0.05)
35-55	0.42*	-0.01	0.56*	0.07*
	(0.03)	(0.03)	(0.03)	(0.03)
56-75	0.43*	0.10*	0.56*	0.16*
	(0.03)	(0.03)	(0.03)	(0.03)
All households	0.43*	0.05*	0.59*	0.10*
	(0.03)	(0.02)	(0.08)	(0.02)

* Significant at the 5 percent level.
Source: HES, PropertyIQ, Author's calculations.

The table also shows that for every percentage point increase in the value of property in real terms since purchase, the level of real non-housing expenditure is likely to increase by approximately 5 percent for all households. Viewing responses by age of household head shows increasing house prices since purchase are more likely to be spent by older homeowners (and mid-age homeowners to a lesser extent). For younger households, increasing property values tend to push down core expenditures, particularly for renter households who face higher implicit future housing costs.

5.2 Predictable vs. unpredictable changes in house prices

If households are forward looking, then the wealth effect of a house price change occurs when the change can be anticipated, not when it actually occurs. On the other hand, predictable changes in house prices – that have already been anticipated - may still relax borrowing constraints even if they have no wealth effect.

In order to gain a better understanding of these mechanisms, I now distinguish between predictable and unpredictable changes in house prices. This assumes that there are predictable changes in house prices, with several papers having documented positive serial correlation in the returns on residential real estate (see Case and Shiller 1989 and Poterba 1991). It also

requires that housing becomes available as collateral only when an increase in house prices is realised and not when it can be predicted. Finally, it requires that borrowing capacity depends on the current price, and not on the purchase price of the house.

If households are forward looking and not collateral constrained we would not expect to see any impact of expected changes in house prices on consumption. If they were collateral constrained, however, even expected increases would trigger more spending. These effects should be the largest and most positive for old homeowners, and should be smallest and negative or zero for young renters, depending on the relative magnitude of the wealth and substitution effects.

I try two different assumptions for house price expectations:

(i) Following Campbell and Coco (2007) I assume households base their expectations on the extent of future real house price appreciation on future prospects for real labour income growth. In the New Zealand case these are assumed to be approximately two percent per annum – equivalent to an assumed annual labour productivity growth of 1.5 percent plus a small risk premia. For non-homeowners this term is assumed to be zero.

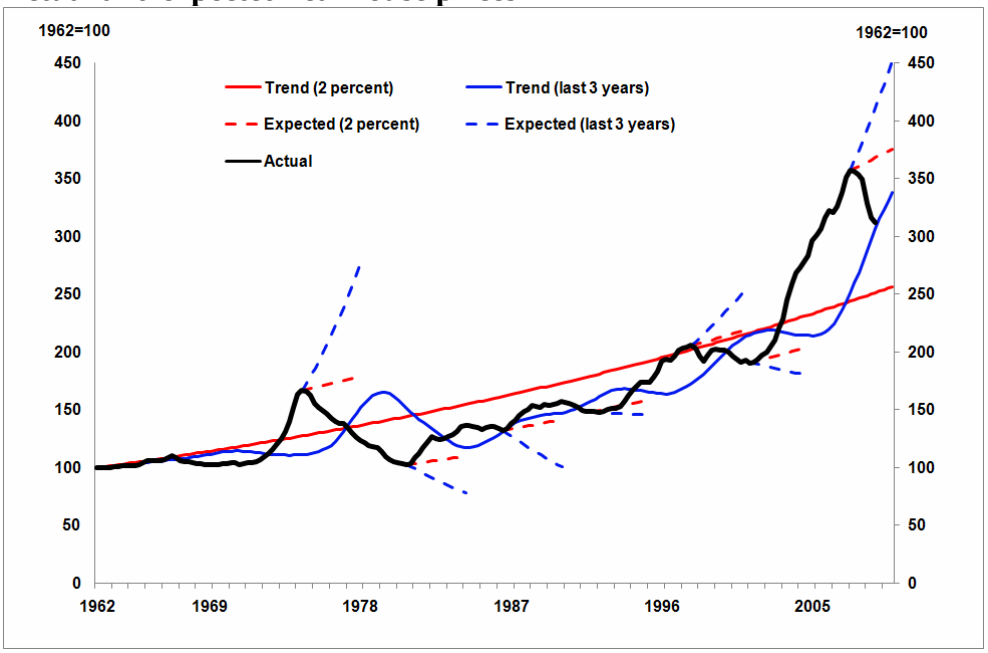
(ii) I assume homeowners base real house price expectations on the average annual change in real house prices over the past three years.

Figure 9 presents a stylised diagram, whereby households purchase a house at various points in time. The dotted lines in the chart denoted the expected path of real house prices under the two assumptions: the constant two percent per annum path is denoted in red, whereas the blue lines show the expected level of real house prices based on the average change over the past three years.

There have been periods where real house prices (black line) have evolved quite differently from this. On average, real house prices actually increased by nearly 4 percent per annum from mid-1983 to mid-2007. This compares with expectations of 2 percent (constant 2 percent assumption), and 2.6 percent (average of past 3 years) respectively.[20] As figure 9 implies, households may not have anticipated the 2002 to 2007 boom.

[20] There have been periods where annual real house price growth has averaged closer to 2 percent; for example, the 1.6 percent increase between 1963 and 1983. From 1962 to 2000, real house prices increased by an average of 1.8 percent per annum.

Figure 9
Actual and expected real house prices



Source: PropertyIQ, Statistics New Zealand, Author's calculations.

The expected increase since purchase can be denoted as follows:

$$HPE^t = HP^b * (1 + rate)^t \quad (7)$$

Where:
HPE^t = predicted real house price value at time t;
HP^b = real house price at date of purchase[21];
Rate = expected rate of annual appreciation; and
HPU^t = unpredicted increase in real house prices at time t.

The surprise or unexpected change in the value of real house prices is the difference between the actual and predicted values at time t. As such:

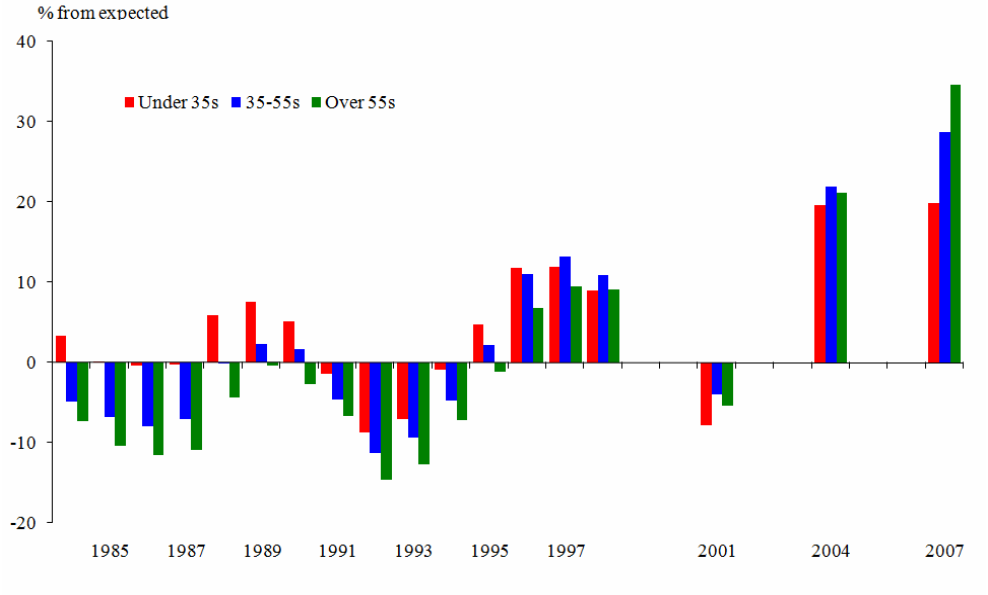
$$HPU^t = HP^t - HPE^t \quad (8)$$

Where:
HPU^t = unpredicted increase in real house prices at time t.
HPE^t = predicted real house price value at time t; and
HP^b = real house price at date of purchase;

[21] I only have house price data available from 1962 so I assume that the purchase price of houses bought prior to 1962 was equal to 1962 values.

Figure 10 summarises the average deviation of house prices from expectations, which assumes expectations of real house price growth is 2 percent per annum. The recent boom in house prices is likely to have exceeded expectations of homeowners, particularly for older households.

Figure 10
Deviation of real house prices from expectations
(expectations of annual house price growth set at 2 percent)



Source: HES, PropertyIQ, Author's calculations.

To ascertain the extent to which expected and unexpected movements in house prices have an impact on household expenditures I add these terms to the equation specification:

$$\ln(Cxh_{i,t}) = \beta 0 + \beta 1 EMR_t + \beta 2 \ln(Y_{i,t}) + \beta 3 \ln(HPE_{i,t}) + \beta 4 \ln(HPU_{i,t}) + \beta 5 Z_{i,t} + \varepsilon_{i,t} \quad (9)$$

Where:
$\ln(Cxh_{i,t})$ is logged real non-housing expenditure for each household;
$\ln(Y_{i,t})$ is logged real disposable household income;
EMR_t is the real effective mortgage interest rate at period t
$HPE_{i,t}$ = the log of the predicted real house price at date of survey (2%pa)
$HPU_{i,t}$ = log difference between actual and predicted real house price
(=$\log(HP_{i,t}) - \log(HPE_{i,t})$); and
$Z_{i,t}$ is a vector of cohort characteristics, demographics, tenure, seasonal dummies.

Table 10 summarises the equation coefficient estimates. The predicted variable (HPE) is assumed to proxy permanent income, and this appears to have a similar impact on core expenditures for each of the three age groups. For every 1 percent increase in real house prices, real ex-housing expenditures will increase by an additional 0.3 percentage points.

Table 10
Expected and unexpected real house price coefficients

Age	Expectations for annual real house price inflation			
	2% per annum		Past 3 years	
	HPE	HPU	HPE	HPU
18-34	0.30* (0.02)	0.23* (0.06)	0.27* (0.02)	0.18* (0.05)
35-55	0.31* (0.02)	0.36* (0.03)	0.28* (0.02)	0.28* (0.03)
56-75	0.31* (0.02)	0.52* (0.04)	0.28* (0.02)	0.34* (0.03)
All households	0.32* (0.02)	0.36* (0.02)	0.28* (0.02)	0.28* (0.02)

* Significant at the 5 percent level.
Source: HES, PropertyIQ, Author's calculations.

Unexpected increases in house prices (denoted HPU) are also likely to boost expenditures. For every percentage point that real house prices rise above their expected level, real core expenditures increase by 0.3 to 0.4 percent. Expenditures of older households appear more sensitive than younger households. This is likely to reflect their lower sensitivity to implied higher housing costs in future. This coefficient appears symmetrical: if house prices dip below their expected level, the core expenditure of the homeowners is likely to be weaker, all else equal.

Changing the expected rate of house price inflation does not significantly change these results, with the sensitivity of unexpected increases in house prices tending to increase with the age of the household.

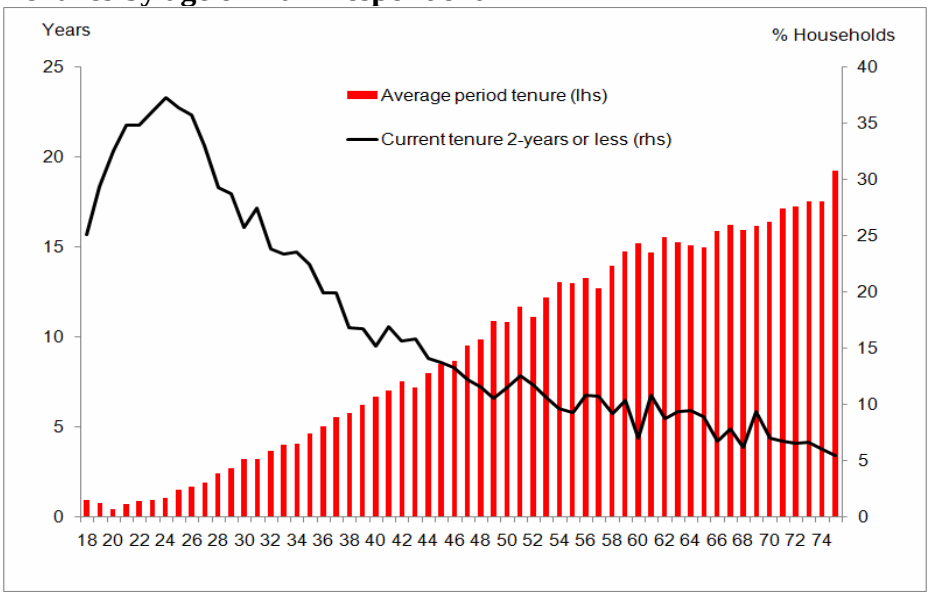
5.3 Period of tenure

In the macroeconomic data a positive correlation is evident between movements in residential investment activity, dwelling sales and durables consumption. It is likely that housing turnover facilitates additional durables consumption as new furniture, fittings and appliances are purchased. It would also be useful to investigate whether the period of tenure is a determinant of households' expenditure.

As mentioned earlier, there is a question in the HES asking respondents the period they have lived in their current dwelling. Hence, it is possible to ascertain whether expenditures of households are related to period of tenure. An investigation of the data also suggested real core expenditures of households that have resided in their own property for two years or less, tended to be higher than the sample average.

Figure 11 shows the average period of tenure by the age of the main respondent household. Period of tenure tends to rise with age. It also shows that a higher proportion of younger households have resided in their current dwelling for a comparatively brief period.

Figure 11
Tenures by age of main respondent



Source: HES, Author's calculations.

Years of tenure (denoted YR) and a dummy variable for recently occupied dwellings (DL2) are added to the baseline equation:

$$\ln(C_{i,t})=\beta_0+\beta_1 EMR_t+\ln(\beta_2 Y_{i,t})+\ln(\beta_3 P_{i,t})+\ln(\beta_4 YR_{i,t})+DL2+\beta_4 Z_{i,t}+\varepsilon_{i,t} \qquad (10)$$

Where:
ln(Ci,t) is the log of real non-housing expenditure for each household;
$EMR_{i,t}$ is the real effective mortgage interest rate at period t ;
$\ln(Y_{i,t})$ is the log of real disposable household income;
$\ln(P_{i,t})$ is the log of real house prices in the region;
$\ln(YR_{i,t})$ is the log of the number of years living in current address;
DL2 = resided in current dwelling for less than 2 years dummy (1,0); and
$Z_{i,t}$ vector of cohort characteristics, demographics, tenure, seasonal dummies;

Table 11 summarises the coefficient estimates for the period of tenure variables within the equation, with the full listing in equation D4 in Appendix D.

After controlling for income, tenure and demographic factors, households who have resided in their current dwelling for less than 2 years (DL2) have real core expenditures that are roughly 13 percent higher. These households constitute approximately 18 percent of all households.

Analysing the responses by tenure shows larger differences for homeowners. For homeowners with mortgages, this may partly be attributable to higher interest payments on a new mortgage. However, the largest proportionate impact is for midage and older homeowners without an outstanding mortgage, suggesting other factors are also at play. For households in paid rented accommodation, the dummy has either a negative sign or is not statistically significant.

Age group coefficients show that the proportionate impact is stronger for older households. It is possible that this group may have downsized with their most recent dwelling transaction, freeing up some funding for consumer spending. However, a relatively small portion of older households (about 8 percent) have recently moved into their current dwelling.

Coefficients on the period of tenure variable (YR) indicate that spending tends to decline with period of tenure. A coefficient 0 -0.09 suggests that real core expenditures are approximately 1 percent lower for every year of tenure. As figure 11 shows the average period of tenure tends to rise with

the age of the main respondent. This suggests a greater impact of tenure on the expenditures of older households. Partly offsetting this, the coefficient estimates for period of tenure tend to be smaller for older households.[22] Removing the house price and the recently occupied dummy term from the equation does not affect the period of tenure coefficients.

Examining the responsiveness by tenure status shows that the expenditures of homeowners with mortgages tend to decline by proportionately more by year of tenure. This is likely to reflect declining mortgage interest payments. It is also apparent, however, that tenure is negatively related to real core expenditures for households without outstanding mortgages and for renter households.

Table 11
Recently moved dummy and years of tenure coefficients
By age of main respondent and dwelling tenure

Age	Renters		Own with mortgage		Mortgage free		Total	
	DL2	YR	DL2	YR	DL2	YR	DL2	YR
18-34**	-0.05* (0.02)	-0.06* (0.01)	0.13* (0.03)	-0.13* (0.02)	0.07 (0.08)	-0.04 (0.04)	0.04* (0.01)	-0.11* (0.01)
35-55**	-0.05 (0.03)	-0.07* (0.01)	0.12* (0.03)	-0.09* (0.01)	0.35* (0.05)	-0.05* (0.01)	0.11* (0.02)	-0.09* (0.01)
56-75**	0.02 (0.07)	0.01 (0.02)	0.18* (0.08)	-0.06* (0.03)	0.30* (0.05)	-0.06* (0.01)	0.24* (0.04)	-0.05* (0.01)
Total	0.04 (0.05)	-0.05 (0.04)	0.13* (0.04)	-0.10* (0.02)	0.30* (0.03)	-0.05* (0.02)	0.13* (0.01)	-0.09* (0.00)
Memo	Percent of households in this category residing in current property for 2 years or less							
	18-34		35-55		56-75		Total	
Own	30		14		8		16	
Rent	27		20		12		23	
Total	30		15		8		18	

* Significant at the 5 percent level.
** Age group coefficients obtained from subgroup regressions.
Source: HES, Author's calculations.

[22] Multiplying the average period of tenure by the equation coefficients implies that, all else equal, the period of tenure tends to weigh down real core expenditures by around 8 percent. Estimates for age groups are around -4 percent, -8 percent and -7 percent for young, midage, and older households respectively.

The dampening impact of tenure on real core expenditures tends to work in the opposite direction suggested by rising house prices. My estimates suggest that, on average, the period of tenure would tend to offset the impact of rising real house prices in the younger age groups, but not for older households where the house price effect dominates.[23] It is important to note that these estimates apply for the full sample period. Over the last 5 to 10 years of the sample, the positive contribution to expenditures resulting from sizeable increases to house prices are likely to have dominated the effect of tenure.

In the aggregate equation both tenure terms are statistically significant and add to the explanatory power of the baseline equation (see equation D4 in appendix D). The real house price coefficient in this specification is the same as in the baseline specification (both 0.34 for the aggregate equation) House price coefficients in this specification are also higher for old age groups.

5.4 Post 1992 sample

There has been structural change within the economy, including financial market deregulation which has improved the accessibility of households to credit. Many of these changes took place in the 1980s and early 1990s. It is also noticeable that annual real house price growth in the 1980s/early 1990s portion of our sample (1.8 percent) is considerably below the average growth rate recorded since 1992 (4.9 percent).

To ascertain whether structural change has had an impact on the equation coefficients, the equations are re-estimated, with the sample beginning in the March 1992 year. Financial liberalisation has made it easier for households to convert housing assets (or other assets including future labour income) into funds that can be used to smooth consumption. If household spending is more responsive to its balance sheet position, we would expect to see evidence of greater responsiveness of core expenditures to house prices and movements in interest costs. Greater accessibility of balance sheet wealth is likely to reduce the precautionary saving buffer by

[23] By combing the house price coefficients in the baseline equation with the average increase in real house price since purchase, it is possible to estimate the marginal impact of higher real house prices on core expenditures. Over the full sample, these are estimated to lift the real core expenditures by 3, 7, and 18 percent for young, midage and older households respectively.

households and could also facilitate greater equity withdrawal by households during periods of housing market strength.

Appendix D summarises the equation results for the baseline equation using a post 1990 sample. The house price terms are broadly unchanged from the full sample, but need to be considered in light of the stronger rate of real house price growth in the post 1992 sample (4.9 versus 3.9 percent per annum). Compared to the full sample estimates, the equation coefficients on real mortgage interest rates are more than twice as large (-0.81 versus -0.38) although they are barely statistically significant at the 5 percent level.

5.5 Examining total household expenditure

This analysis has used an ex-housing measure of expenditure as a proxy for household consumption. It would be informative to see if the equation findings also apply for total household expenditures. I re-estimate the baseline equation with real total household expenditure as the dependent variable.

Equation results are summarised in equation D6 in Appendix D. The coefficient on real house prices is positive and statistically significant, although the smaller than for the core expenditure equation in the baseline specification (0.21 versus 0.34). Like the results for core expenditure equation, the house price coefficients tend to be larger for owner occupier households without an outstanding mortgage and tend to rise with the age of the main respondent. The period of tenure is negatively related to total expenditures, although expenditures for households who had just moved into a new dwelling were not noticeably higher than for other households.

6 Summary of findings

A number of different specifications for including house prices have been used. These have been used to quantify the extent to which core expenditures of different age cohorts of the population and house prices have tended to move together. They have also been used to clarify whether housing tenure is an important factor in determining the responsiveness of household expenditure to house price movements.

Table 12 summarises the tenure and age subgroups which are most responsive to the house price terms within each of the equation specifications. This is largely based on the reported house price coefficients for the various age and tenure groups, and the improvement in equation fit that was yielded by adding the house price terms to the equation.

In order to discern the extent to which the relation in different age and tenure groups will affect the economy-wide relation it would be useful to examine their respective population and expenditure shares. As table 2 suggests the proportion of household who own their own home averaged around 75 percent over the HES sample period, although this share has been declining as homeownership rates have eased. Total and core expenditures of homeowners tend to be higher, on average, further reinforcing the idea that whatever influence tends to drive this group would tend to determine the economy-wide impact.

These findings provide evidence of a wealth effect taking place. The rise in house prices has boosted the balance sheet wealth of homeowners which has been converted into spending. The expenditure response tends to rise by the age of the homeowner. The milder response of younger households is likely to reflect the impact of higher house prices on raising future housing costs: not only is it more expensive to get onto the property ladder, but trading up to a more expensive property is also going to cost more.

Table 12
Ages and tenures most responsive to house prices

Equation	Sign	Subgroup		Predominant influence
House Price term		Tenure	Age	
Baseline (Levels)	Positive	Owners	Older (56-75)	Wealth
Alternatives:				
Change since purchase	Positive	Owners	Older (56-75)	Wealth
Expected/unexpected	Positive	Owners	Older (56-75)	Wealth
Recently moved	Positive	Owners	Midage Older	Wealth
Period of tenure	Negative	Owners	Midage Older	

Shifts in the age structure of the population and homeownership patters need to be borne in mind when interpreting equation estimates. A larger proportion of households are now in midage and older age groups, with the trend towards declining rates of homeownership and a lower proportion of homeowners being mortgage free becoming more evident.

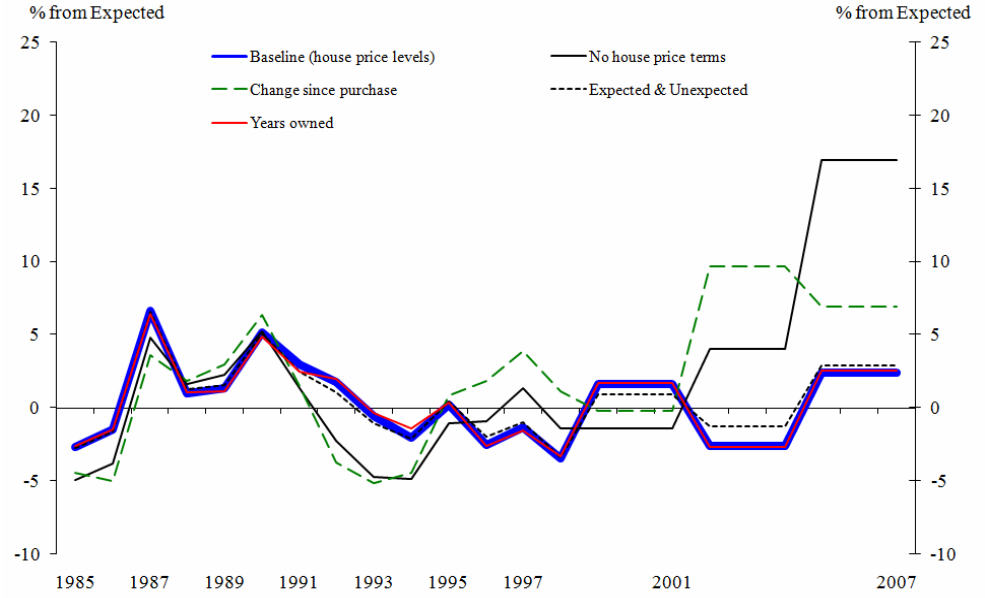
The period of tenure results present some interesting findings. Households who have recently moved into a dwelling tend to have much higher core expenditures, irrespective of whether they have a mortgage. Larger proportionate increases were for midage and older homeowners without mortgages who may have downsized with their most recent dwelling transaction, freeing up funding for consumer spending.

The period of tenure is negatively related to real core expenditures. A comparison of age group coefficients suggests the decline in expenditure for each year of tenure tends to be slightly larger for households with outstanding mortgages, possibly due to declining interest payments. However, a negative relationship is also evident for other households. By virtue of their longer period of tenure, the largest overall impact is for midage and older households. Over the last few years of the sample, the positive contribution to expenditures from higher house prices is likely to have dominated the effect of tenure.

Figure 12 compares the aggregate residual plots for the various equation specifications. The baseline specification (which includes the level of house prices) account for much of the pick-up in real core expenditures since the start of the decade. If house prices are not included in the equation, a sizeable portion of consumption is unexplained.

Examining the baseline equation residuals by age group (as seen in Appendix E) shows that the level of core household expenditure has been stronger for older households than explained by the baseline equation towards the end of the sample.

Figure 12
Average residuals from aggregate equation



Source: HES, PropertyIQ, Author's calculations.

Implications for household spending in the current environment

Since mid-2007, the New Zealand housing market has slowed significantly, and is currently in what appears to be a significant correction. So far, house prices have fallen by around 13 percent in real-terms, and there is likely to be more to come. The level of real private consumption per-capita also peaked in 2007, and has eased slightly since then.

What are the implications for household spending? Some of the findings in this paper suggest the effects of house prices on household expenditures are likely to be symmetric. Equation coefficients suggest that a 10 percent fall in real house prices would lower real core expenditures by 3 to 4 percent relative to baseline levels. We would expect expenditures of homeowners to be most affected, particularly older homeowners whose spending has risen strongly in the boom period.[24]

[24] Since mid-2007 household credit growth has sharply eased. This has facilitated a turn-around in housing equity withdrawal, from a position of net withdrawal to one of net injection. This implies less support to consumer spending going forward. See Smith (2006).

Balance sheet coverage in the HES is partial, with little information on financial asset holdings by households. While Reserve Bank estimates suggest total share equity holdings are quite low for New Zealand households in relation to housing equity (roughly 10 percent of total net household wealth versus around 70 percent in 2007[25]), the greater fall in equities since their 2007 peak (and closer synchronisation with house prices this time around) suggests the impact on consumer spending could be larger than implied by these equation estimates.

However, other findings suggest falling house prices may take some time to have an impact on household expenditures. As this paper has shown, increases in housing equity have been substantial for many homeowners. Providing households have access to finance and are happy to not significantly alter their precautionary saving buffer, this may limit the extent to which spending will adjust.

The dataset over which these results are obtained spanned a period of sizeable increases in house prices (the early 1990s excepted). It would be useful to examine the expenditures of the next HES (2009/10) and to update this analysis.

7 Conclusions

Linkages between expenditures and house prices may be driven by a variety of mechanisms, including wealth and substitution effects, credit constraints, precautionary savings, or even myopic behaviour by households. This research confirms findings in the macroeconomic data which report a positive relationship between house prices and consumer expenditure, However, it goes deeper and draws out which age cohorts appear to be driving this relationship, and whether spending of other groups is dampened by rising house prices.

Econometric analysis of a cross sectional dataset is used to quantify the factors relating to household expenditures.

[25] See www.rbnz.govt.nz/statistics/monfin/ for Reserve Bank estimates of the value of total assets and liabilities for New Zealand households.

Key results are as follows:

- Real core household expenditures are positively related to real house prices for all age groups. However, the responsiveness of expenditures to house prices tends to rise with the age of the main household respondent.
- Real core expenditures of homeowners tend to be more responsive to house price movements than households living in paid rental accommodation. This effect is largest for homeowners without outstanding mortgages.
- Regional differences in house price have an impact on consumer spending, over and above the effects explained by national house prices. After controlling for household incomes and demographics, real core expenditures tend to be higher in the Auckland region than for other regions.
- Real core expenditures are higher for homeowners who have recently moved into their current dwelling. Proportionate effects are largest for homeowners without mortgages who may have downsized with their most recent dwelling transaction, freeing up funding for consumer spending.
- By the end of the HES sample (June 2007 year), increases in housing equity are likely to have been substantial for many homeowners. This could limit the extent to which household spending will ease in response to subsequent falls in house prices.
- Generally, real household expenditures are negatively related to the period of tenure. By virtue of their longer period of tenure, this suggests a larger impact on real expenditures of midage and older households. Over the last few years of the sample these effects on real core expenditures are likely to have been offset by the positive effects on spending implied by higher house prices.
- Findings are generally unchanged when the sample is shortened to post 1990 observations, although there is weak evidence that household expenditures are more sensitive to interest rates.

These findings suggest that the house price and consumption relation is most consistent with the presence of a wealth effect. Higher house prices boost notional balance sheet wealth and facilitate additional consumption spending. As older households are less susceptible to higher future housing

costs and are likely to trade down with their next dwelling transaction, their core expenditure responses are larger than for other homeowners.
Evidence pointing to collateral constraints and common influences is less compelling. Although house prices are positively correlated to core expenditures of renter households, higher house price coefficients for older renter households suggest the relationship is not being driven by income expectations. The greater responsiveness of expenditures for homeowners without mortgages also suggests that collateral constraints are unlikely to explain the positive correlation between house prices and consumption evident in the macroeconomic data.

Results suggest the degree of sensitivity of core household expenditures to interest rates vary. Possibly reflecting different net financial asset positions, core expenditures of younger and mid-age households are negatively related to real interest rates, but a positive relation is evident for older homeowners. Expenditures of households living in paid rental accommodation and homeowners with an outstanding mortgage are negatively related to mortgage interest rates, whereas evidence for homeowners without an outstanding mortgage was inconclusive.

With the last HES coinciding with the peak in the most recent house price cycle we are now in a different environment, with both real house prices and real private consumption per-capita still below 2007 peaks at the time of writing. It would be useful to update this analysis in future years to examine the consumption responses of individual households in the post boom period. These will help to shed some light of the findings reported here.

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Appendix A
Data sources

Data used in this study is based on the following HES variables:

Tothhexp	Total household expenditure (net of sales, trade-ins, refunds).
Housing	Annual household expenditure on housing & household utilities (includes rent, mortgage principal, property maintenance).
Cxh	Total expenditure less housing (Tothhexp-housing) (adjustments made to2006/07 HES for changes in expenditure classifications)
Age	Age of main respondent in HES questionnaire
Heduqual	Highest educational qualification
Dpes	Current employment status
Child	Number of children in household
Numpers	Number of persons in household
Tenure	Tenure of dwelling
Occup	Month & year household occupied dwelling
TA	Territorial area of household (TA)
Dpes	Current employment status
HH_disp	Nominal household disposable income

Non-HES variables

Ncp_p	SNA private consumption deflator
EMR	Real effective mortgage interest rates (private consumption deflator)
Pnz	QV New Zealand house price index
Pa	QV Auckland house price index
Poth	Other region house price measure (Poth = (Pnz – w*(Pa))/(1-w), where w=Auckland portion of households in HES)
Pr	Regional house price measures (Pa for Auckland and Poth for other regions)
Prentr	Median weekly rent for Auckland and New Zealand. (Derived variable (Statistics New Zealand (1983-93), Ministry of Housing (1993-)),

Appendix B
Baseline regression specifications

Explanatory variable is log(cxh_)
(robust standard errors in parentheses, *denotes significance at 5% level).

Equation	B1	B2	B3	B4	B5	B6
Constant	3.52* (0.30)	2.39* (0.32)	2.31* (0.30)	3.48* (0.30)	4.69* (0.30)	3.50* (0.30)
$\ln(Y_t)$	0.48* (0.01)	0.70* (0.01)	0.52* (0.01)	0.49* (0.01)	0.50* (0.01)	0.48* (0.01)
EMR_t	-0.38* (0.08)	-0.26* (0.08)	-0.29* (0.08)	-0.39* (0.08)	-0.48* (0.08)	-0.39* (0.08)
$\ln(Pr_t)$	0.34* (0.02)	0.30* (0.02)	0.31* (0.02)	0.33* (0.02)		
$\ln(P_t)$						0.33* (0.02)
$\ln(Pr_t)-\ln(P_t)$						0.41* (0.09)
Co2	0.02 (0.02)	0.05 (0.02)	0.03 (0.02)	0.02 (0.02)	0.12* (0.02)	0.02 (0.02)
Co3	0.02 (0.02)	0.05* (0.02)	0.03 (0.02)	0.01 (0.02)	0.22* (0.02)	0.02 (0.02)
Co4	-0.01 (0.03)	0.02 (0.03)	0.00 (0.03)	-0.02 (0.03)	0.28* (0.02)	-0.01 (0.03)
Co5	-0.06 (0.03)	0.03 (0.04)	-0.05 (0.03)	-0.06 (0.03)	0.34* (0.02)	-0.05 (0.03)
Age	-0.06* (0.03)	-0.11 (0.03)	0.01 (0.03)	-0.07* (0.03)	-0.08* (0.03)	-0.06* (0.03)
Age2	0.00* (0.00)	0.00* (0.00)	0.00 (0.00)	0.00* (0.00)	0.00* (0.00)	0.00* (0.00)
Age3	0.00* (0.00)	0.00* (0.00)	0.00 (0.00)	0.00* (0.00)	0.00* (0.00)	0.00* (0.00)
Age4	0.00* (0.00)	0.00* (0.00)	0.00 (0.00)	0.00* (0.00)	0.00* (0.00)	0.00* (0.00)

Equation	B1	B2	B3	B4	B5	B6
DqDec	0.10* (0.01)	0.10* (0.01)	0.10* (0.01)	0.10* (0.01)	0.10* (0.01)	0.10* (0.01)
DqSep	-0.08* (0.01)	-0.08* (0.01)	-0.08* (0.01)	-0.08* (0.01)	-0.08* (0.01)	-0.08* (0.01)
DqMar	-0.03* (0.01)	-0.03* (0.01)	-0.03* (0.01)	-0.03* (0.01)	-0.03* (0.01)	-0.03* (0.01)
Numads	0.22* (0.01)		0.23* (0.01)	0.22* (0.01)	0.22* (0.01)	0.22* (0.01)
Child	0.01* (0.00)		0.02* (0.00)	0.01* (0.00)	0.01* (0.00)	0.01* (0.00)
Dnlf	-0.13* (0.01)		-0.15* (0.01)	-0.13* (0.01)	-0.13* (0.01)	-0.13* (0.01)
Dsec	0.14* (0.01)		0.17* (0.01)	0.15* (0.01)	0.17* (0.01)	0.14* (0.01)
Dpost	0.20* (0.01)		0.23* (0.01)	0.21* (0.01)	0.22* (0.01)	0.20* (0.01)
Drent	-0.14* (0.01)			-0.15* (0.01)	-0.14* (0.01)	-0.14* (0.01)
Dmort	0.14* (0.01)			0.13* (0.01)	0.13* (0.01)	0.14* (0.01)
Dauck	0.10* (0.01)			0.10* (0.01)	0.10* (0.01)	0.10* (0.01)
Dothp	0.22* (0.02)					
R^2	0.408	0.355	0.391	0.404	0.401	0.404
Obs	49,814	49,814	49,814	49,814	49,814	49,814

Appendix B (cont)

Equation listing for appendix B:
B1 = baseline specification (i) in table 5 (main baseline specification).
B2 = baseline specification (ii) in table 5
B3 = baseline specification (iii) in table 5
B4 = baseline specification (iv) in table 5
B5 = baseline specification not in table 5
B6 = baseline specification (v) in table 5

Equation variables:

Cxh	Total expenditure less housing
Co1 – Co5	Cohort dummies (1,0, see table 4)
Age	Age of main respondent in HES questionnaire
Age2	Age^2
Age3	Age^3
Age4	Age^4
Dsec	High school education for main respondent only (1,0)
Dpost	Post school qualification for main respondent (1,0)
Dnlf	Main respondent not in labour force dummy (1,0)
Child	Number of children in household
Numads	Number of adults in household (numpers-child)
$In(Y_t)$	log of real household disposable income
$In(Pr_t)$	log of real regional house price index
$In(P_t)$	log of real New Zealand house price index
Drent	Living in paid rental accommodation dummy (1,0)
Dmort	Living in owner occupied residence with mortgage (1,0)
Dauck	Resides in Auckland region dummy (1,0)
Dqdec,Dqsep,Dqmar	Seasonal dummies (1,0)
EMR_t	Real effective mortgage interest rate
Dothp	Making payments on another property dummy (1,0)

More detailed regression specifications and other information available upon request.

Appendix C Age and tenure equation summaries for baseline regression

Explanatory variable is log(cxh_)
(robust standard errors in parentheses, *denotes significance at 5% level).

Equation	C1	C2	C3	C4	C5	C6
Constant	1.39* (0.32)	3.15.* (0.30)	4.59* (0.30)	5.13* (0.48)	4.20* (0.71)	2.50* (0.82)
$In(Y_t)$	0.40* (0.02)	0.45* (0.01)	0.59* (0.02)	0.40* (0.02)	0.53* (0.02)	0.47* (0.02)
EMR_t	-0.51* (0.13)	-0.70* (0.12)	0.22 (0.18)	-0.49* (0.16)	-0.52* (0.11)	-0.14 (0.16)
$In(Pr_t)$	0.19* (0.03)	0.32* (0.03)	0.49* (0.04)	0.19* (0.03)	0.31* (0.03)	0.47* (0.03)
Co2		0.07 (0.08)	0.0 (0.02)	0.08 (0.05)	-0.06 (0.04)	0.01 (0.02)
Co3		0.06 (0.08)	-0.09 (0.05)	0.12* (0.06)	-0.08* (0.04)	-0.02 (0.04)
Co4	0.02 (0.02)	0.02 (0.09)		0.10 (0.07)	-0.09 (0.05)	-0.07 (0.05)
Co5	0.02 (0.03)	0.01 (0.09)		0.13 (0.07)	-0.14* (0.06)	-0.17* (0.07)
Age	1.11 (1.21)	-3.54 (1.87)	-1.05 (1.10)	-0.14* (0.05)	-0.14* (0.07)	-0.04 (0.07)
Age2	-0.06 (0.07)	0.12 (0.06)	0.02 (0.02)	0.01* (0.00)	0.01* (0.00)	0.00 (0.00)
Age3	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00* (0.00)	0.00* (0.00)	0.00 (0.00)
Age4	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00* (0.00)	0.00* (0.00)	0.00 (0.00)

Equation	C1	C2	C3	C4	C5	C6
DqDec	0.08* (0.01)	0.09* (0.01)	0.14* (0.02)	0.09* (0.02)	0.07* (0.01)	0.14* (0.02)
DqSep	-0.08* (0.02)	-0.07* (0.01)	-0.10* (0.01)	-0.07* (0.02)	-0.10* (0.01)	-0.07* (0.02)
DqMar	-0.03* (0.02)	-0.03* (0.01)	-0.02 (0.02)	-0.04* (0.02)	-0.05* (0.01)	0.00 (0.02)
Numads	0.28* (0.01)	0.18* (0.01)	0.22* (0.01)	0.28* (0.01)	0.15* (0.01)	0.23* (0.01)
Child	-0.02* (0.01)	0.04* (0.00)	0.02 (0.01)	0.02* (0.01)	0.00 (0.00)	0.07* (0.01)
Dnlf	-0.15* (0.01)	-0.15* (0.01)	-0.05* (0.02)	-0.20* (0.02)	-0.15* (0.02)	-0.05* (0.02)
Dsec	0.13* (0.01)	0.16* (0.01)	0.13* (0.02)	0.16* (0.01)	0.11* (0.01)	0.16* (0.02)
Dpost	0.21* (0.01)	0.21* (0.01)	0.17* (0.02)	0.25* (0.01)	0.17* (0.01)	0.19* (0.02)
Drent	0.02 (0.02)	-0.15* (0.02)	-0.23* (0.02)			
Dmort	0.29* (0.02)	0.14* (0.01)	0.06* (0.02)			
Dauck	0.10* (0.01)	0.11* (0.01)	0.07* (0.02)	0.08* (0.01)	0.10* (0.01)	0.12* (0.02)
Dothp	0.26* (0.03)	0.20* (0.02)	0.24* (0.03)	0.28* (0.04)	0.15* (0.02)	0.25* (0.02)
R^2	0.359	0.342	0.375	0.412	0.331	0.360
Obs	14,884	21,549	13,381	13,312	18,359	18,323

Appendix C (cont)

Equation listing for appendix C:
C1 = Main respondent aged between 18-34 (equation 5)
C2 = Main respondent aged between 35-55
C3 = Main respondent aged between 56-75
C4 = Main respondent living in paid rented accommodation
C5 = Main respondent living in own home with mortgage
C6 = Main respondent living in own home without mortgage

Equation variables:

Cxh	Total expenditure less housing
Co1 – Co5	Cohort dummies (1,0, see table 4)
Age	Age of main respondent in HES questionnaire
Age2	Age^2
Age3	Age^3
Age4	Age^4
Dsec	High school education for main respondent only (1,0)
Dpost	Post school qualification for main respondent (1,0)
Dnlf	Main respondent not in labour force dummy (1,0)
Child	Number of children in household
Numads	Number of adults in household (numpers-child)
$In(Y_t)$	log of real household disposable income
$In(Pr_t)$	log of real regional house price index
$In(P_t)$	log of real New Zealand house price index
Drent	Living in paid rental accommodation dummy (1,0)
Dmort	Living in owner occupied residence with mortgage (1,0)
Dauck	Resides in Auckland region dummy (1,0)
Dqdec,Dqsep,Dqmar	Seasonal dummies (1,0)
EMR_t	Real effective mortgage interest rate
Dothp	Making payments on another property dummy (1,0)

More detailed regression specifications and other information available upon request.

Appendix D Alternative house price regressions

Explanatory variable is log(cxh) for equation D1-D5
Explanatory variable is log(tothhexp_) for equation D6
(robust standard errors in parentheses)
* denotes significance at 5% level.
**Estimated jointly in regression D1-3, estimated in age group regression in D4-5.

Equatio	D1	D2	D3	D4	D5	D6
Constant	1.82* (0.31)	3.21* (0.37)	3.34* (0.36)	3.58* (0.30)	3.49* (0.44)	6.01* (0.18)
In (Y_t)	0.50* (0.01)	0.48* (0.01)	0.48* (0.01)	0.48* (0.01)	0.44* (0.01)	0.39* (0.01)
EMR_t	-0.30* (0.08)	-0.38* (0.08)	-0.36* (0.09)	-0.36* (0.08)	-0.82* (0.41)	-0.39* (0.05)
Co2	-0.02 (0.02)	0.01 (0.02)	0.05* (0.02)	0.02 (0.02	0.01 (0.03)	-0.02* (0.01)
Co3	-0.06* (0.02)	0.01 (0.03)	0.06* (0.02)	0.01 (0.02)	0.02 (0.04)	-0.4* (0.01)
Co4	0.12* (0.03)	-0.01* (0.03)	0.05 (0.03)	-0.04 (0.03)	0.01 (0.05)	-0.08* (0.02)
Co5	-0.22* (0.04)	-0.04* (0.03)	0.03 (0.03)	-0.08* (0.03)	0.02 (0.06)	-0.10* (0.02)
Age	0.03 (0.03)	-0.01 (0.04)	0.00 (0.00)	-0.07* (0.03)	-0.04 (0.04)	-0.08* (0.02)
Age2	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00* (0.00)	0.00 (0.00)	0.00* (0.00)
Age3	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00* (0.00)	0.00 (0.00)	0.00* (0.00)
Age4	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00* (0.00)	0.00 (0.00)	0.00* (0.00)
DqDec	0.10* (0.01)	0.10* (0.01)	0.10* (0.01)	0.09** (0.01)	0.07* (0.12)	0.05* (0.01)
DqSep	-0.08* (0.01)	-0.08* (0.01)	-0.08* (0.01)	-0.08** (0.01)	-0.07* (0.13)	-0.02* (0.01)

Equation	D1	D2	D3	D4	D5	D5
Numads	0.23* (0.01)	0.22* (0.01)	0.22* (0.01)	0.23* (0.01)	0.23* (0.01)	0.18* (0.00)
Child	0.02* (0.00)	0.01* (0.00)	0.01* (0.00)	0.02* (0.00)	0.02* (0.00)	0.02* (0.00)
Dnlf	-0.16* (0.01)	-0.13* (0.01)	-0.13* (0.01)	-0.13* (0.01)	-0.14* (0.01)	-0.11* (0.01)
Dsec	0.15* (0.01)	0.15* (0.01)	0.15* (0.01)	0.14* (0.01)	0.19* (0.01)	0.11* (0.01)
Dpost	0.21* (0.01)	0.20* (0.01)	0.21* (0.01)	0.19* (0.01)	0.28* (0.01)	0.16* (0.01)
Drent	-0.13* (0.01)	-0.13* (0.01)	-0.13* (0.01)	-0.21* (0.01)	-0.15* (0.01)	-0.09* (0.01)
Dmort	0.13* (0.01)	0.13* 90.01)	0.14* 90.01)	0.11* (0.01)	0.12* (0.01)	0.12* (0.01)
Dauck	0.09* (0.01)	0.10* (0.01)	0.10* (0.01)	0.11** (0.01)	0.10* (0.01)	0.07* (0.01)
Dothp	0.21* (0.01)	0.23* (0.01)	0.22* (0.01)	0.22* (0.01)	0.25* (0.02)	0.15* (0.01)
	House price and housing tenure terms					
In($Pr_{t,you}$**)	0.41* (0.03)	0.30* (0.02)	0.27* (0.02)	0.20* (0.04)	0.16* (0.03)	0.13* (0.02)
In($Pr_{t,mid}$**)	0.42* (0.03)	0.31* (0.02)	0.28* (0.02)	0.28* (0.03)	0.30* (0.03)	0.20* (0.02)
In($Pr_{t,old}$**)	0.43* (0.03)	0.31* (0.02)	0.28* (0.02)	0.49* (0.04)	0.47* (0.03)	0.29* (0.02)
$APr_{t,you}$	-0.11* (0.05)	0.23* (0.06)	0.18* (0.05)			
$APr_{t,mid}$	-0.01 (0.03)	0.36* (0.03)	0.28* (0.03)			
$APr_{t,old}$	0.10* (0.03)	0.52* (0.04)	0.34* (0.03)			
$\ln(YR_t)$				-0.09* (0.00)		-0.06* (0.00)
DL2				0.13* (0.01)		
R^2	0.402	0.408	0.407	0.419	0.433	0.550
Observations	48,381	49,686	49,686	49,126	23,535	49,122
	Memo item: Aggregate coefficients					
Pr_t	0.43* (0.03)	0.31* (0.02)	0.28* (0.02)	0.34* (0.02)	0.31* (0.02)	0.21* (0.01)
APr_t	0.05* (0.02)	0.36* (0.02)	0.28* (0.02)			

Appendix D (cont)

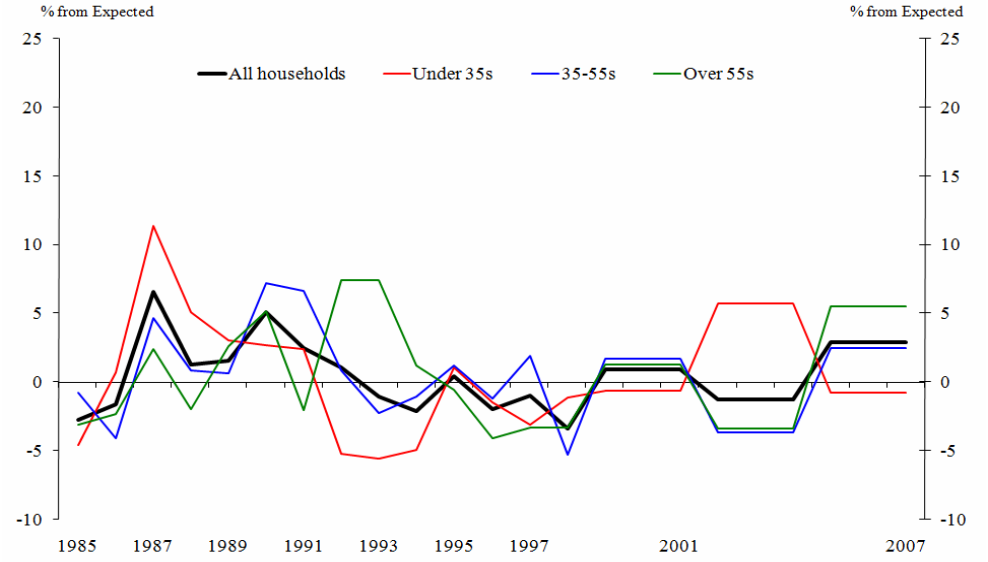
Equation listing for appendix D:
D1 = Change since purchase, interacted with age (equation 6)
D2 = Expected and unexpected, interacted with age (9, 2% growth)
D3 = Expected and unexpected, interacted with age (9, average past 3 years)
D4 = Year owned (10)
D5 = Baseline equation (1992- sample, 5)
D6 = Real total household expenditure equation

Equation variables:

Cxh	Total expenditure less housing (Tothhexp-housing)
Torhhexp	Total household expenditure (Bank adjustments
Co1 – Co5	Cohort dummies (1,0, see table 1)
Age	Age of main respondent in HES questionnaire
Age2	Age^2
Age3	Age^3
Age4	Age^4
Dsec	High school education for main respondent (1,0)
Dpost	Post school qualification for main respondent (1,0)
Dnlf	Main respondent not in labour force (1,0)
Numads	Number of adults in household (numpers-child)
Child	Number of children in household
Lhh_disp_	log(real HHDI)
Dqdec,Dqsep,Dqmar	seasonal dummies (1,0)
EMR_t	Real effective mortgage interest rate
Drent	Living in paid rental accommodation dummy (1,0)
Dmort	Living in owner occupied residence with mortgage (1,0)
Dauck	Resides in Auckland region dummy (1,0)
Dothp	Making payments on another property dummy (1,0)
YR_t	Years residing in current dwelling
DL2	Resided in current dwelling 2 years or less, dummy (1,0)
DG5	Resided in current dwelling 5 years or more, dummy (1,0)
Pr_t	Real regional house price term in equation specification (value of house when purchased for equation D1, expected level of house prices for equation D2 $Pr_{t,you}$ main respondent aged 18-34 $Pr_{t,mid}$ main respondent aged 35-55 $Pr_{t,old}$ main respondent aged 56-75)
APr_t	Additional house price term in equation specification % change since purchase for equation D1 = $((P_t)/(P_{buy})-1)*100$ Unexpected change in house prices for D2 =$\ln(P_t)$– $\ln(Pe_t)$

Appendix E
Equation residual plots

Figure E.1
Age subgroup regressions of the baseline equation



Source: HES, Author's calculations.

Figure E.2
Post 1992 sample